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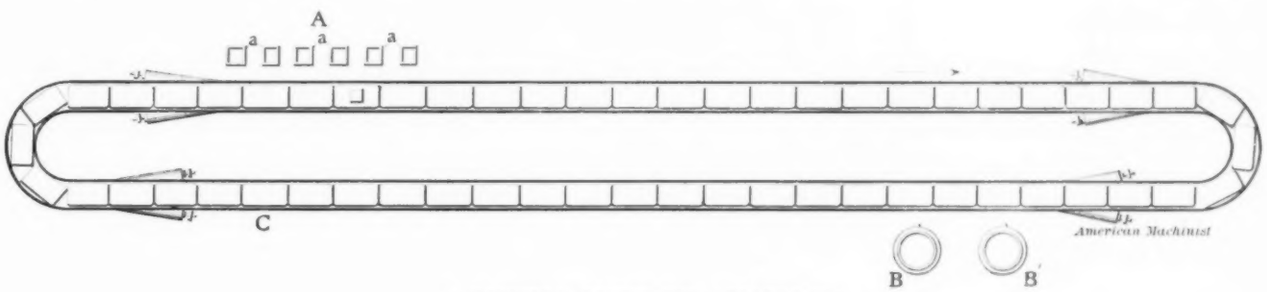
A Foundry Conveying Apparatus.

The arrangement shown in the accompanying cut, which is from a patent issued the present year, may perhaps be regarded rather as embodying a suggestion for improved foundry practice than as a record of the actual, although we are informed that it has been tried experimentally and that a more complete and permanent installation has been determined upon. The place of its origin and the personality of its designer afford strong presumption of the practicability of the arrangement, or at least bespeak for it fair consideration. The inventor is Mr. L. D. Castle, superintendent of the Kelly & Jones Company, of Greensburg, Pa., the extensive manufacturers of pipe fittings.

The arrangement has been devised for facilitating the process of continuous molding, where the pouring of the molds may be carried on all the day, instead of, as has been the general practice, doing it all in an hour or two of the afternoon. It is applicable, of course, principally in foundries where small castings are made in large quantities, a condition eminently characteristic of the establishment where it has originated. Referring to the cut, Fig. 1 is an endless tank or canal, which is filled with a single line of floats constantly kept moving forward, and each capable of carrying a finished mold from the molding floor to the cupolas; then on to the cleaning floor, and bringing back the sand and flasks, if any are used, to the molder, and so on continuously. The molding machines, if machines are used, are at *A*, the cupolas at *B*, B^1 and the cleaning floor at *C*. The movement of the endless line of floats is slow, so that no stoppage is made at any point, there being no difficulty in pouring, which is done by hand ladles, as many pourers being employed as may be necessary. Different devices are employed for keeping the line in motion. The simplest arrangement seems to be the propellers placed obliquely to the channel, as at *E E*, to keep the water constantly moving and the endless string of floats also. A means of direct mechanical propulsion for the floats has also been devised. The floats under that arrangement are provided with rollers on the under side and each also has a downwardly projecting lug. At a point opposite the cupolas the inner walls of the tank for a considerable distance are fitted with angle bars, which form a track for the rollers to run on. The level part of this track is of such a hight as to partially raise the floats out of the water while they are traversing it, and the track slants downward at each end sufficiently to allow the rollers to pass on and off with ease. At each end of this track is a sprocket wheel, to one of which power is applied, and the endless chain passing over them catches the lugs of the floats as they come along. The floats thus driven at one point push the others before them all around the tank.



A FOUNDRY CONVEYING APPARATUS.

This arrangement, it will be seen, is new not in what it proposes to accomplish, but in the means employed, as endless tracks and also overhead conveyers have already been used, both for foundry service and elsewhere. The practice of continuous casting is becoming more general.

Time Saving in Planing.

BY HENRY HESS.

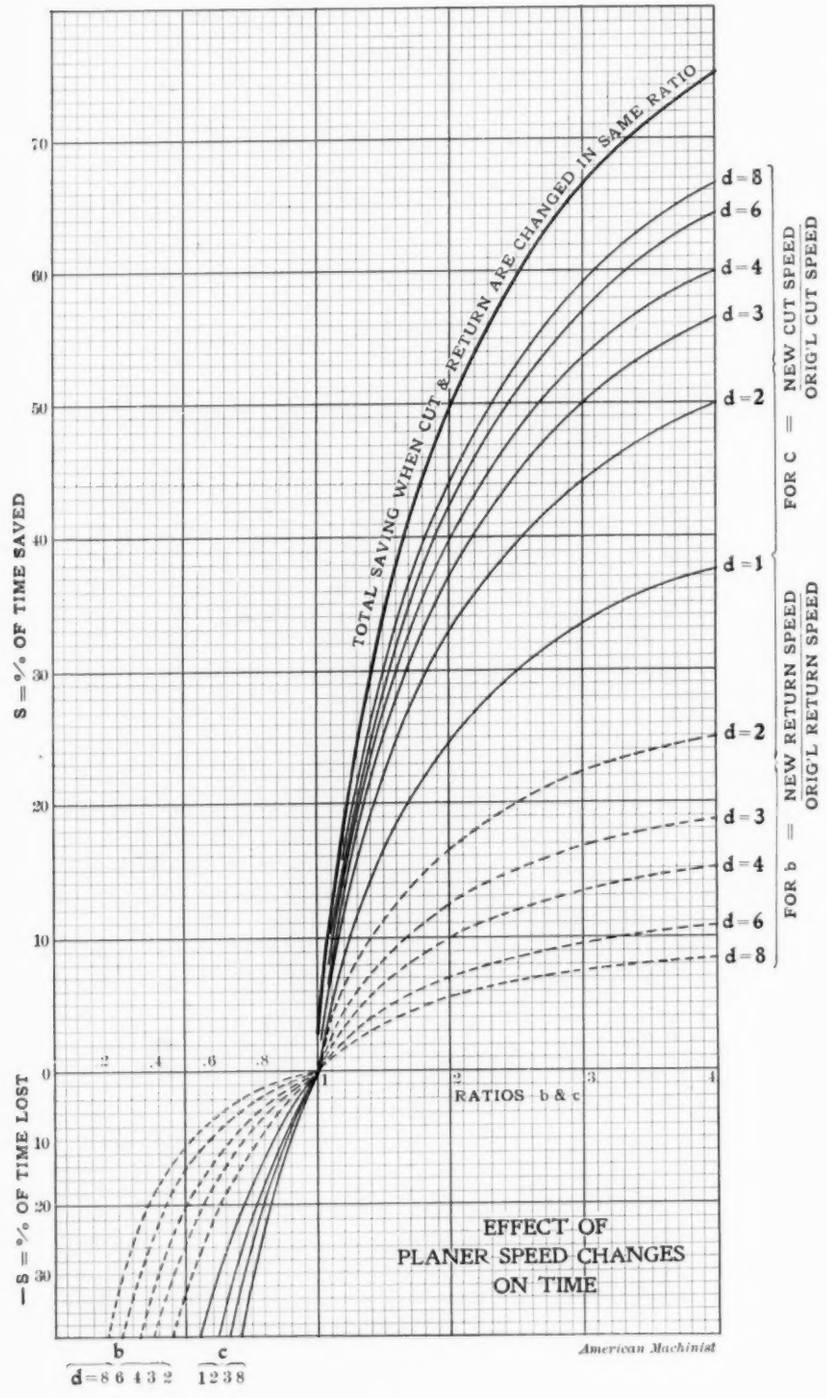
Within a few years past considerable attention has been given to the matter of quick return for planer tables. Not so long ago a return of 2.5 to 1 of cut was a fair average; to-day this is 3.5 and 4 to 1, and at least one maker has put out planers with a return ratio to cut of 8.

Next to the unsuccessful "jim crow" device for making the machine cut during both strokes, the most obvious way for increasing the output of the planer is to decrease the time of the idle stroke by increasing the rate of return. Doubling this, so as to make the ratio of return to cut 2 to 1, was readily accomplished without unduly increasing breakages, and resulted in a time saving of 25 per cent. Further progress in the same direction has up to the present again doubled the return speed, making the ratio to the cut equal 4, with the attendant saving of another 12½ per cent. Note that this second doubling has brought in only half the saving due to the first doubling; a third doubling to ratio 8 will give only 6¼ per cent saving, and so on.

In this striving after economy by lessening the obvious loss due to the idle stroke, another element has been largely lost sight of by planer users and designers. In the early days this was comparatively unimportant; but with the present great variety of materials used in machine building, the careful manager should see to it that the rate of cut is the highest that work and tool will

stand; and this he does, until it comes to planing, but then the old and familiar cry of "quick return" and yet "quicker return" fills his ears and shuts his mind to all else. Naturally, there are exceptions; in some of the large shops with many planers these are run at various rates of cutting speed; but even so, as each planer has but one rate of cut, more or less work must be done at speeds other than the best. In no other tool would such a condition of affairs be tolerated. Why, even in so relatively unimportant a machine as the cutting-off lathe it is by no means exceptional to find provision made for changing the revolutions as the tool moves toward the center, in order to keep up the proper cutting speed. By all means then let us have a planer with a fair range of cutting speeds to select from, say, 15 to 35 feet per minute, with as many intermediate speeds as practicable. Say that such a planer can be had, what will it save in time? As a basis of comparison planers such as are at present rather in the forefront of practice will be used; these have a cut speed of 20 feet per minute, with a return at the rate of 80 feet per minute—4 to 1.

With an unaltered rate of return, a rate of cut at 25 feet per minute will give a saving of 16 per cent. of time; at 30 feet per minute will give a saving of 26 per cent. of time, and at 35 feet per minute will give a saving of 34.3 per cent. of time. The ratio of increase of cut-speed cited is 1.25, 1.5 and 1.75. Similar ratios of increase in return rate, without increase of cut, will give for return at 100



EXAMPLES.

Cut increase — 1.5 — c.

Return ÷ cut — 4 — d.

Return unchanged:

Trace c — 1.5 up to full d curve 4, refer to S scale for time saved — 26⅔ per cent.

Cut unchanged,

Orig'l return ÷ cut — 4 — d.

Return increase — 1.5 — b:

Trace b — 1.5 up to dotted d curve 4, refer to S scale for time saved — 6⅔ per cent.

Return and cut both increased in ratios b — c — 1.5; orig'l return ÷ orig'l cut — 4 — d:

Refer b and c — 1.5 up to heavy outer curve, refer to S scale and read time saved — 33⅓ per cent.

For different return and cut increase ratios b and c:

Find time saving S for each as above, and add for total saving.

If speeds are decreased time is lost; find percentage by short — S curves in same manner as above.

Formula:

$$S = 100\left(1 - \frac{\frac{1}{c} + \frac{1}{d\,b}}{1 + \frac{1}{d}}\right)$$

Result — S means loss.

If b — c

$$S = 100\left(1 - \frac{1}{c}\right)$$

feet per minute a time saving of 4 per cent.; at 120 feet per minute a time saving of 6.7 per cent., and at 140 feet per minute a time saving of 8.6 per cent.

A comparison of the time saved by these two methods shows the great importance of the highest possible cut-rate, and the relatively small value of further increase of speed on the return stroke.

In case a planer were to be so designed that both cut and return rate could be increased in the same ratio, then an increase of cut and return in ratio of 1.25 will give a time saving of 20 per cent.; an increase of 1.5 will give a time saving of 33.3 per cent., and of 1.75 will give a time saving of 42.6 per cent.

The value of any change in cut or return speed rate expressed as a per cent. of time saved may be calculated from the formula

$$S = 100 \left(1 - \frac{\frac{1}{c} + \frac{1}{d\,b}}{1 + \frac{1}{d}}\right)$$ in which

S = per cent. of time saved.
b = ratio of new return speed to original return speed rate.
c = ratio of new cut speed to original cut speed rate.
d = ratio of original return speed to original cut speed rate.

If the cut speed only is increased without change of return $b = 1$. If the return speed only is increased without change of cut $c = 1$.

The application of this formula may be shown by an example. Assume that a planer has a cut speed of 20 feet and a return of 80 feet per minute. Increase the speed of both cut and return 1½ times when

$$b = 1.5$$
$$c = 1.5$$
$$d = 4.$$

Inserting these values gives

$$S = 100 \left(1 - \frac{\frac{1}{1.5} + \frac{1}{6}}{1 + \frac{1}{4}}\right)$$
$$= .33$$

The correctness of this formula may be shown in a practical way by working out this case by the ordinary method, when the results will be found to agree with the above.

A quicker way of arriving at the same answer is given by the diagram, which possesses the further advantage of conveying a clear idea of the relative value of various changes.

The vertical scale gives the per cent. of time saving S; the horizontal scale gives the ratios b and c of the new and original return and cut speed rates. A series of curves are given for the various rates d of the original return and original cut speed rates. For each value of d there are two curves, one full, the other dotted. Reference to the full curve gives the time saving when the cut speed rate only is changed; reference to the dotted curve gives the time saving when the return rate only is changed. Reference to the upper extra heavy full curve gives the time saving when both cut and return rates are changed in the *same* ratio; it represents the sum of the savings found by considering the effect of cut and return rate changes separately. When the ratio of change of the cut and return speed rate is not the same, the total saving is to be found by adding the saving given by reference to the full and dotted curves marked with the ratios in question.

It may happen that for hard or tough materials speeds must be decreased; in that case a loss of time results; this is given by those portions of the curves that lie below the horizontal ratio scale. In the formula this is indicated by S coming out as a minus quantity.

Concise directions in the shape of examples of the use of the diagram are given on the latter.

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Black-Print Processes.—II.

BY ALBERT E. GUY.

The water-bath black-print paper is made in two ways:

First Process—After sensitizing the paper with an appropriate solution gallic acid, very dry, is rubbed by hand against its surface, or the paper is made to pass between two rollers, which press the acid against it, a felt roller or a long brush removing afterward the excess of acid. Such prepared paper can be used advantageously when only a few copies of a tracing are required, but if it is necessary to make a large number of prints from the same tracing this latter must be well brushed after each exposure, because the pressure of the glass in the printing frame, to which it is subjected, tends to apply a coating of acid to its under side. This acid prevents the light from acting upon the sensitized paper, and consequently, on developing, large black clouds are seen on the print, giving it a dirty appearance and blurring the lines.

The hands of the operator, impregnated by the gallic acid, are blackened by the contact of any article of iron, and the color is quite hard to remove.

A formula, called the Shawcross, is generally used to make the sensitized solution, and for the benefit of those who want to try this process it is given here:

	Grammes.
Water	11,000
Gelatine	1,500
Iron chloride	1,500
Iron sulphate	600
Tartaric acid	188
Sodium chloride	940

This solution is very thick; it is quite evident that the quantity of water is not sufficient. I have never been able to make a success with the above proportions, but have obtained very good results with the following:

	Parts.
Water	280
Gelatine	15
Tartaric acid	2
Sodium chloride	9.2
Iron chloride	15
Tersulphate of iron solution	21

If the gallic acid is applied as soon as the sensitized paper is dried it will adhere to the surface, but it is very difficult to apply it uniformly. This process is employed only because manufacturers wanted to comply with their customers' wishes, and, not being able to produce a direct water-bath paper, compromised by bringing forward this article.

When developing the print the water must not be squirted upon the sheet for fear of washing away the gallic acid. It is preferable to lay the sheet in a shallow tray containing fresh water; after washing for five or six minutes hang up to dry.

Second Process—When experimenters try at first to find this process they generally begin by utilizing the acid bath solution, thinking that it is only necessary to add to it the developer. This developer is either gallic acid or tannic acid. As no method is followed for experimenting the results are discouraging, and soon the searchers are looking for a substance having the property of preventing the reaction of the tannin on the iron salts in the solution and upon the sensitized paper, while after exposure the said substance must become neutral to the action of those chemicals; and they try everything they can think of. If they follow a method they study the properties of the acids and become convinced that the task is not possible unless chance favors.

Tannic acid in aqueous solution is precipitated by the following acids: Sulphuric, hydrochloric, arsenic, phosphoric, boric. The precipitates have long been considered as combinations of the tannin and the acids; they are white, soluble in water and insoluble in an excess of acids; but recent experiments seem to indicate that they are produced only by the tannin, which, being less soluble in the acid solutions than in pure water, deposits when any energetic acid is added. Nitric acid transforms the tannin into oxalic acid. Tannic acid precipitates nearly all the salts containing organic alkalies. Gelatinous solutions are completely precipitated by tannin. The two last reactions are not shared by gallic acid, while the first ones are.

It is quite hard to imagine a substance, neither acid nor alkaline, capable of preventing the reactions between the iron salts and the tannin. As for gallic acid, since it reduces the ferric salts into ferrous, it is itself reduced—that is, it loses some oxygen; the only way to bring the iron salts into their former state is to boil

the solution. The inconvenience of this method is that the solution deposits very soon and is extremely difficult to keep in good condition. Having made over 3,000 experiments with numero s chemicals and all the papers available on the market, I am of the opinion that the tannic process is the best.

While studying the properties of the iron salts, gum arabic and tartaric acid I found that a solution containing iron perchloride and gum arabic, when spread on paper and dried, produces an insoluble film, even in hot water, whereas a solution with iron perchloride, gum arabic and tartaric acid forms a nearly insoluble film, as found by Poitevin. When dipped, even in cold water, the film dissolves to some extent. This is due to the tartaric acid, which is very soluble in water. The next important thing to find is the method for applying the developer. Having sensitized with the ordinary black-print solution and perfectly dried several strips of paper about 3 inches wide I applied to each, by means of a glass rod, a solution of tannic acid in water different for each strip. The original tannin solution was made 1 to 8 and was divided into about ten parts; to each of these parts was added one of the following acids: Sulphuric, nitric, muriatic, phosphoric, oxalic, tartaric, citric, boric, acetic, in various proportions. After the application of this second solution the film took a tint varying from gray to black. The sulphuric acid gave the lightest tint. Upon exposing to the light under a tracing, the various papers, all printed with different lengths of exposure, and after washing in water, they all reproduced the lines of the tracing, but the background was tinted. The lightest tint, slightly gray, was that of the sulphuric acid paper. Similar experiments, made with alkalies instead of acids, did not produce any good result. As soon as the solution was applied to the film this latter turned black. It was evident that sulphuric acid was the best agent to employ. After many trials the following solution was arrived at:

	Parts.
Water	100
Tannic acid	13
Sulphuric acid	5

We have seen that sulphuric acid precipitates tannin from its aqueous solution, but there is a way to prevent this. Dissolve the tannin in 6½ times its weight of water, and when the liquid is very clear add slowly the sulphuric acid, mixed with the remaining quantity of water. After a small amount has been poured in the bottle containing the tannin solution a precipitate tends to form, then shake well the bottle until the solution is clear again. Shake this bottle vigorously after each addition until the last drop of acid is added. This solution remains clear and does not form any precipitate for more than forty days.

If good quality paper is sensitized with the solution given in the first paper and is well dried, the above tannin solution can be applied on the surface of the first film. The paper, again dried, will have on its sensitized face a light gray tint.

An exposure of about four minutes, or the same as the acid developer paper, is necessary. Taken from the frame the print shows in dark gray lines upon a yellowish ground. The developing is done by immersing the sheet in clean water until the lines are dark blue. It is not possible to obtain absolutely black lines, but with a good tracing very good work may be done. It is preferable instead of immersing the print immediately in water to use a hose, and thus send a jet of water against the surface of the paper. This has the effect of detaching more readily the decomposed salts from the film and to activate somewhat the developing. After two or three minutes the print is immersed in water for five or six minutes and then hung up to dry. It is necessary to often renew the water in the bath because the iron salts washed away are affected by the air and tend to assume a light blue tint, which would be communicated to the prints after about one dozen had been washed in the same bath. This precaution must be taken for all black-print processes.

If the iron or sensitizing solution such as advocated is used, no matter how well dried the paper may be before the developing solution is applied, the presence of the tartaric acid in such quantity is bound to render the first solution soluble, and consequently some of the iron salts mix with the tannin, darken the liquid, and after a while spoil the developer, *i. e.*, form a precipitate which it is hard to dissolve again. The iron salts, iron perchloride and tersulphate, if mixed with the gum arabic in water, will form an insoluble compound when dry, as we have seen. When only a small quantity of tartaric acid is added the insolubility remains; consequently, for a certain amount of iron solution put only one-half the quantity of tartaric acid and put the other half in an equal quantity of the developing solution. It is understood that the paper, in order to be uniformly coated, must be treated by machinery. It would be impossible to coat any large amount by hand, since any irregularity shows on developing.

(Conclusion.)

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Third Assistant Secretary of State Thomas J. Cridler has been appointed by the President to carry on the work begun by the late Moses P. Handy in connection with the Paris Exposition of 1900, and Mr. Cridler expects to sail for Paris on the 26th inst., accompanied by Lieutenant Baker, of the Navy.

A Rubber Mold Hint.

BY A. H. CLEAVES.

A good many years since I worked in a shop where glass, block tin and rubber mold making was a prominent part of the curriculum, and a little thing, in itself, relating to a rubber pencil top mold has come to mind a number of times since, and I give a description of it, presuming it may be entertaining and perhaps useful.

The mold was made of three cast iron plates, like Fig. 1, and arranged one above the other, as shown in Fig. 2, in section, with a sheet iron plate, containing the eight-sided forms, between the top and middle cast iron plate.

The cores or pins for forming the hole in the rubber were made of steel wire and driven into the lower plate from the back or lower side. They had to be driven in pretty tight, and when slightly undersize were marked lengthwise with a cold-chisel to make them fit.

This driving so many pins (144, I think) in a mold curved the lower plate, which was straightened by peening the upper side between the pins.

But a more serious difficulty in the work was that of uprighting the pins so that they would enter the holes in the middle plate freely and yet not allow the rubber to go through. This was one of those simple things, like the Columbus egg trick of balancing the same on end by setting it down hard enough; but simple as it was it made a formidable hitch in the program for awhile. My employer was a very devout man, and after doing what he could to work out his own salvation he used to take a difficulty to the Great Master Mechanic in prayer, and in this case found a solution in this way. At any rate he had a good sized contract hanging by the gills just on account of this little obstacle, and after praying about it one night he dreamed of the following device, and put it into successful practice at once.

It was not only a difficult matter to find one or more slightly leaning pins, but equally hard to straighten them just enough when found. By using a cast iron collar, as shown in plan *A*, Fig. 1, and in section *A*, Fig. 2, the perpendicular of the pins was determined very readily. The face *B* of *A* being trued off at right angles with the hole *C* furnished the best of tests by being whirled around each pin; the surface *B* having a thin coat of red lead and marking the surface of the plate *D* opposite the leaning side of the pin; so showing the side to be struck in straightening. A hollow steel piece, somewhat longer than the pins, was slipped onto a pin to hammer against; avoiding marring or kinking the latter.

The taper dowel-pin *E*, Fig. 2, is all right anywhere. It is fitted to holes in the lugs or ears on *G*, *H*, *D*, shown in

plan at *F*. It is then driven into *G*, and the holes in *H* and *D* are reamed out to required freeness, and if this is overdone the hole in *G* can be reamed a little deeper and *E* driven further in.

The plan of the pencil-tip is seen at *K*, Fig. 3; the core-pins at *J*, the sheet iron plate at *I*, and the letters *L* show

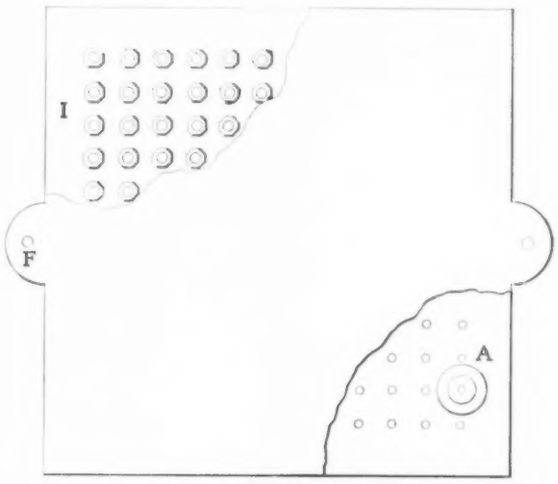

Fig. 1

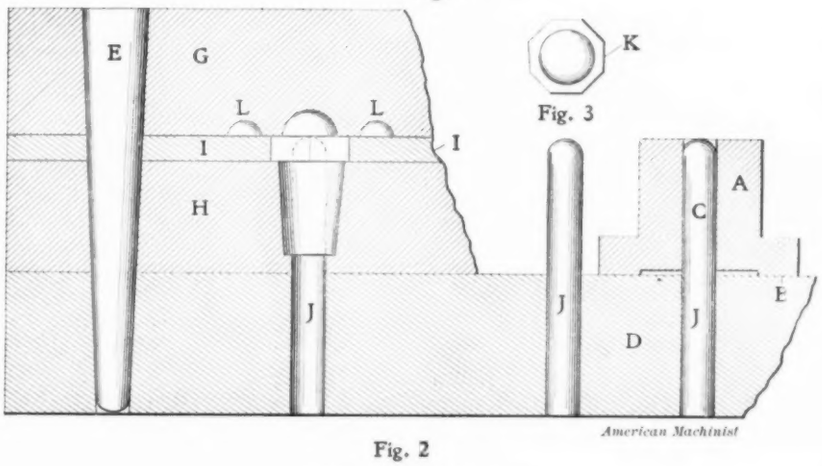

Fig. 2

A RUBBER MOLD JOB.

Fig. 3

one of a set of circles, corresponding to the number of pins, for the surplus rubber outlets.

Chicago, Ill.

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Internal Stresses in Castings and Forgings.

Probably a good many cases of so-called mysterious failures are due to the internal stresses, or, as Mr. H. K. Landis calls them, residual stresses, remaining in the steel from improper treatment.

The researches of James Howard, of the Watertown Arsenal, of Martens, Chernoff, Bauschinger, and others, have not only experimentally proved the presence of such stresses, but the great school of experience, and that invaluable teacher, comparative knowledge, gives us ample evidence from time to time of the injurious presence of internal stresses.

The sudden and unexpected cracking of iron and steel casting without apparent cause, is quite well known, and understood to be due to shrinkage and molecular changes in the metal.

Not so well known, nor so easily demonstrable, is this phenomenon in rolled and hammered material, because masked by other complex conditions.

How can we tell of the presence of internal stresses? I know of no means to detect them in finished material before it goes into service, although an experienced person can see by the way steel is treated in the mill or shop whether internal stresses will be developed or not. Some years ago in a beam mill the flanges of an I-beam were slotted off and the web shrunk ⅛ of an inch in its total length when freed from the restraining influences of the flanges.—P. Kreuzpointner, in an address before the Engineers' Club of Philadelphia.

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The British War Office asks for tenders for 250 tons of electrolytic copper, which must be of American manufacture.

Some Engineering Designs, as Shown in Intercepting Valves for Locomotives.

Since the invention, in 1776, of the compound steam engine, by Jonathan Hornblower, many inventors have tried to utilize the compound principle for locomotive practice.

Numerous patents have been taken out that have not been further developed, and the first man to actually build and run a compound locomotive was Mr. John Nicholson, an English "engine driver"—this was in 1850.

About fifteen years ago the subject of fuel economy by compounding on locomotives was taken up actively in France, Russia, Germany and England; and stories of successful compounds started American locomotive builders to designing engines of this class.

Some of the inventions made by our designers were and are fearful and wonderful, but these already have found, or soon will, find their proper place in the scrap heap.

These conditions call for some form of tled down to this: That the successful compound locomotive will have the smallest number of parts, the lightest reciprocating parts, the fewest steam joints, and be the simplest, both in mechanism and in the handling of steam from boiler to exhaust.

These conditions call for some form of a two-cylinder compound.

Now, a two-cylinder compound is practically the every-day locomotive, with the exception of one enlarged cylinder and the proper valves to convert a compound into a single engine and vice versa.

A locomotive must exert her greatest tractive force in starting, and it is therefore necessary that the compound shall use live steam in the low-pressure cylinder in order to start her train. This should be reduced in pressure to make the work done on each side of the locomotive nearly the same. To this problem our inventors addressed themselves, and accomplished it in several different ways.

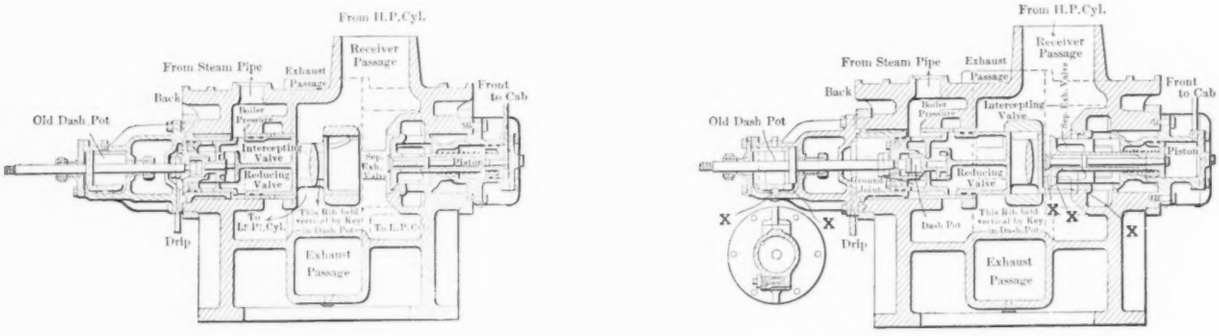
The readers of the "American Machinist" are not, we take it, so much interested in the history of compounding or the relative economies obtained, or claimed to be obtained; what interests them is how the results were accomplished—the designing, the engineering.

In the first place, live steam at reduced pressure must be taken into the larger cylinder in order to start. Then the exhaust steam from the high-pressure cylinder must be sent through the receiver to the low-pressure cylinder, and from there exhausted into the stack. Easy enough to say, but not so easy to do, meeting all the conditions of train service.

Three of the most successful two-cylinder compounds built in this country are

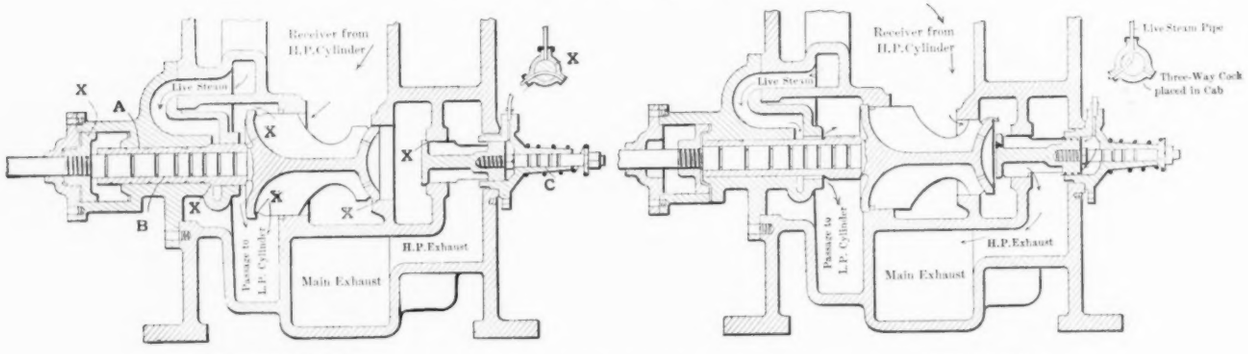
those turned out by the Schenectady, the Richmond and the Pittsburg locomotive works, and drawings of their intercepting and reducing valves are here submitted as examples of engineering design.

Take, for instance, the Schenectady valve. Its normal position is the compound position, and it automatically assumes this position if left alone. To prevent shock to itself, in its automatic action, an oil cylinder, with piston connected to stem of the intercepting valve, is provided at one end of the device.



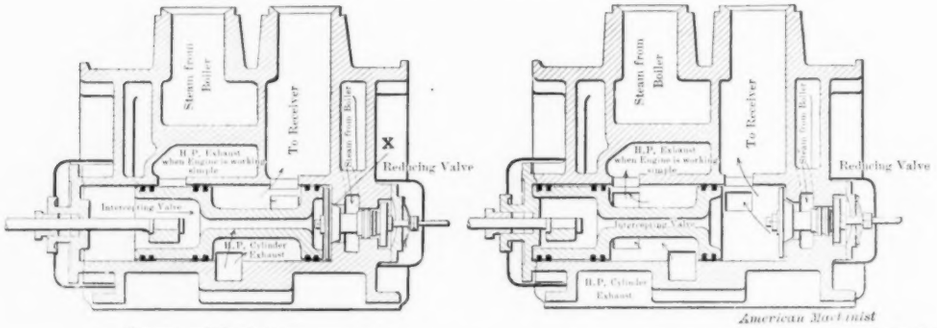
Compound Position. Simple Position.

SCHENECTADY INTERCEPTING VALVE.



Compound Position. Simple Position.

RICHMOND INTERCEPTING VALVE.



Compound Position. Simple Position.

PITTSBURG INTERCEPTING VALVE.

If the engineer wishes to use the maximum pull of the engine to start his train he turns a three-way cock in the cab that lets steam from the boiler behind the little piston shown to the extreme right of this valve. This forces open the larger valve behind it, which opens a separate exhaust passage from the high-pressure cylinder to the atmosphere.

Then, when the throttle is opened steam enters the passage over the left center and marked "from steam pipe," forces the intercepting valve to the right and onto a seat at the right-hand end. Then steam enters the high-pressure cylinder as usual, but is exhausted into the receiver and out of the extra exhaust port, while live steam also enters the large cylinder through the reducing valve carried in the center of the intercepting valve. This reducing valve is the usual differential area valve commonly used in reducing pressures.

When the engineer releases the pressure behind the piston, to the right, the spring on the separate exhaust valve throws it to the right, closing the escape of steam from the receiver to the atmosphere; this causes the pressure in the receiver to rise, forces the large intercepting valve to the left against the unbalanced boiler pressure, acting on a small area of the valve at that end. This movement gives a free passage for the high-pressure exhaust through the receiver to the low-pressure chest, and the engine is working compound.

In steam engine design it is usually conceded to be good practice to avoid steam joints that may cause losses by leaks, and that cost money to make and keep in order.

In these valves we will ignore ground joints for covers of cylinders, or chests that are bolted down, for while they are ground joints, they are made tight once, bolted up and left alone. Valves with packing rings are also ignored, but ground joints that move on each other and are supposed to prevent leaks are counted: In this valve we find six steam joints, counting the three-way cock in the cab. A leakage in any one of these is a loss.

The Richmond valve is somewhat similar in action to the one just described. Live steam is admitted through a cock

located in the cab behind a piston shown at extreme right of the valve; this opens the separate exhaust valve attached to it.

Live steam being admitted behind the left end of the intercepting valve, it is shoved over to the right, opening the receiver to the exhaust passage opened by the separate exhaust valve and putting into operation the reducing valve at the left. This is simply a sleeve with restricted openings, and makes no attempt to reduce the pressure of live steam going to the low-pressure cylinder, in proportion to the areas of the cylinders. Behind this pressure-reducing device is a dash-pot to prevent shocks.

When the pressure in the small cylinder to the right is released the spring (located outside the valve) closes the separate exhaust valve, the increasing receiver pressure forces the intercepting valve over, closing the reducing valve, shutting off live steam to the large cylinder and compounding the engine.

This device has seven ground joints, but it does away with packing rings, except one small pair on the separate exhaust valve.

The Pittsburg valve goes at the problem in another way. First, the intercepting valve never moves automatically—it is moved either by the hand of the engineer or by an automatic steam piston actuated by the reverse lever—some force entirely outside itself.

When it is desired to start simple, or run continuously so, the intercepting valve is pulled to the left, this opens the high-pressure cylinder exhaust to the atmosphere through an open passage, at the same time opening the passage from the reducing valve to receiver.

Now the boiler pressure opens the differential reducing valve, admitting live steam to the receiver. The differential areas of reducing valve cause this live steam to be reduced so that the work done in each cylinder is the same.

When it is desired to compound, the intercepting valve is moved over to the right; this closes the passage to the reducing valve entirely, opens the high-pressure exhaust to the receiver, and, of course, closes the exhaust port from the high-pressure cylinder to the atmosphere.

This valve has only one ground joint—that on the reducing valve—and this is not necessary, for it can cause no loss by leakage, as the intercepting valve closes the passage behind it in any event.

As an example of good engineering design we must consider it much superior to the others shown, or to any other device, American or foreign, yet designed for the same purpose. We are well aware that all three of these devices are in daily use and each accomplishing the results aimed at, but this does not alter the fact that one of them has elements of simplicity in construction, operation and maintenance superior to the others, and is therefore the best engineering.

An Interstate Combination.

The recent decision rendered by the United States Circuit Court of Appeals for the Sixth District, sitting at Cincinnati, seems to be of considerable importance to manufacturing concerns who may be contemplating the formation of combinations; not because it will prevent such combinations, but because it shows just what features must be avoided in the formation and conduct of them. The suit was brought in the name of the United States by the Attorney-General, and it was claimed that the combination in question, known as the Cast Iron Pipe Trust, was contrary to the Federal Anti-Trust law of 1890.

The concerns forming the trust were the Addyston Company, of Cincinnati; Dennis Long & Co., of Louisville; the Chattanooga Pipe Works, of Chattanooga; the South Pittsburg Pipe Works, of South Pittsburg, Tenn.; the Anniston Pipe Works, of Anniston, Ala., and the Howard-Harrison Company, of Bessemer, Ala.

The brief for the Government, presented in May, 1897, at Nashville, Tenn., opened with the following statement:

"The six appellees above named have formed a combination under the name of the Associated Pipe Works. They are powerful enough to control completely the market for cast iron pipe in some portions of the United States and to control it partially in other portions—their only rivals in the latter case being certain companies whose output enables them to compete only to a limited extent.

"These associated companies have divided the United States, for their purposes, into two portions. One of these is called free territory. The other is called pay territory. Certain municipalities are set apart under the name of reserved cities. Each of these municipalities is assigned to the care of some one of the six associates. The others cannot compete with it. For its monopoly it pays a premium or bonus into the pool. The rest of the pay territory is also deprived of the benefits of competition as between the six associates. When a contract for cast iron pipe is to be awarded by any unreserved municipality, gas company, water company, railroad company, or other large consumer, the associates do indeed bid against each other for the contract: but the bidding is among themselves only, and not for the benefit of the consumer. The price has already been fixed by their own committee. The bidding is to decide which of the six shall obtain the contract. The highest sum bid is a premium or bonus which is paid into the pool, and divided up among the associates according to a prearranged schedule of proportions.

"The details of the scheme will be more fully considered at a later point in this argument. It may be summarized as a successful attempt by companies having a partial monopoly of the cast iron pipe trade in certain portions of the United States to abolish competition among themselves, so that the difference between the maximum obtainable price and the lowest price affording a fair profit shall go into the pool and be divided among themselves. The restraint is not placed upon the manufacture of the pipe, but upon the commerce in it, and this in every instance is interstate commerce."

The combination seems to have been declared illegal mainly, if not solely, because, in accordance with the custom of the trade, pipes were delivered by the makers at points where they were to be used, and this delivery involved in many cases interstate commerce. It is probable that if pipes are not delivered by the manufacturers the combination can stand, and if it is not practicable to do business in that way a corporation formed for the purpose can buy all the plants and operate them, and probably this will be done.

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Our Engravings.

Some misunderstanding (which has been helped along by interested parties) has arisen regarding our practice in respect of illustrating our articles. We take occasion, therefore, to state the facts.

We make, for our own use, all the engravings which appear in the reading columns of the "American Machinist." They are made entirely and solely at our own expense. We do not use in our reading columns engravings taken from manufacturers' catalogs or those which belong to anyone except ourselves.

In some cases those who make, or are otherwise interested in, machines we happen to illustrate have afterward purchased the engravings, simply because we, having no further use for them, are willing to sell them much below their original cost, and, of course, much below the regular cost of engravings of equal quality. There is, however, no obligation, expressed or implied, in the matter. Our engravings are not offered for sale until after we have used them, and when afterward purchased it is done solely for the reasons given above. Many of them are not purchased from us at all. Those who really want to know what our practice is regarding this or any other point can readily ascertain by addressing an inquiry to this office. Information given by representatives of publications which are imagined to be in competition with ours is exceedingly likely to be misleading. Of course the engravings in our advertising columns are furnished by the advertisers from any source they please.

Electricity and the Machinist.

In the second of the Columbia University lectures on "Electrical Engineering," at the American Museum of Natural History, on February 11, Prof. F. B. Crocker, whose topic was "The Generation of Electrical Energy," took occasion to speak a few earnest words in correction of the generally false and mistaken view of electricity and of electrical practice and experience as held by too many mechanics and by people in general. While it is true enough that we know nothing of the ultimate forces or phenomena of nature, of gravity or light or heat, of magnetism and electricity, it is not true that there is any more of mystery about the latter, or that there is any less known or less clearly and surely known of them than of the others. The electrician knows what he is doing as clearly as does the steam engineer or the hydraulic engineer. He measures as finely, he traces cause and effect as clearly, he reasons as closely, his results are secured by the intelligent adaptation of means to ends as entirely as in any line of human activity. The successful electrician does not advance by guesswork, and there is as little of the cut and try method in his work as is to be found anywhere, and probably a less measure of success therefrom. The vast and rapid progress of the electrician speaks for itself and overwhelmingly indorses the wisdom and the energy by which it has been secured.

This, which seems to be indisputable, is worth more than a passing thought It is full of encouragement and incentive. The attitude of the average mechanic has been too long a cowardly one. It has been also, and is to-day, a losing one. It has been regarded all along as eminently proper for all to know as much as possible about steam and the steam engine, and it has been held that all such knowledge has been constantly open and accessible to the diligent student, but electricity has been all a mystery, and the pursuit of it has been considered hopeless and unprofitable except to a favored few. Men have not been ashamed to confess, if not to boast of, their utter ignorance of all electrical knowledge. Undoubtedly this is all a mistake. This is an age of electricity as truly as it is an age of steam. Electrical knowledge is as accessible as any other and as necessary as any other, and mechanics without it in these days are more or less handicapped in life's race. The sooner this is realized, as it inevitably must be, and the sooner all advantage is taken of waiting opportunities, the nearer and firmer will be our success. A good beginning in the matter would be the learning of the electrical language. We should learn first of all to look at volts and amperes, ohms and watts without shying in our reading.

A Scotch Machine-Tool Shop.

On page 463 last year I gave some account of some of the things to be seen in a Scottish machine shop, wherein they make a specialty of building heavy tools. This shop is that of Thomas Shanks & Co., and is located at Johnstone, which is a small manufacturing town 10 miles west of Glasgow, and to reach which one passes through Paisley, an important textile manufacturing place, which enjoys the distinction of having given its name to a certain kind of shawl which was at one time very popular here in America, and is perhaps still worn to some extent.

In the letter referred to I spoke of the form adopted by Shanks for the slides of planers; of a form of nut for traversing screws, which was solid, yet so made that it would pass over a support for the screw without the necessity for removing

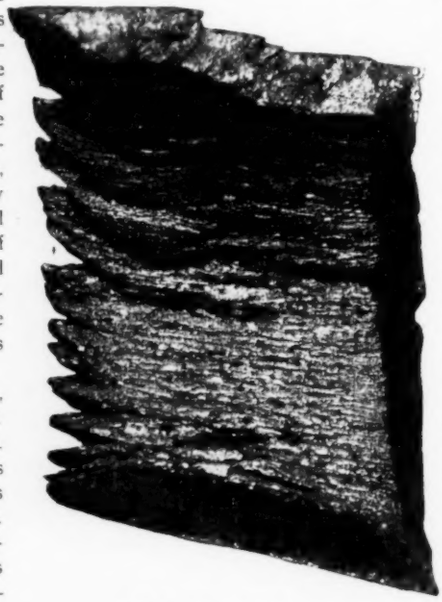

FIG. 1—A HEAVY CHIP.

the support; of Mr. Shanks' belief in the importance of ample diameters for transmission shafts and traversing screws used in heavy tools, and I gave the dimensions of a chip of steel which had been removed from a shaft in the course of ordinary work by one of the Shanks lathes, operated in his own shop. I brought this chip home with me, and managed to get it through the Custom House without paying duty on it. It astonishes every mechanic who sees it, but I notice that the astonishment is most plainly manifested when they take it in hand and note its weight. Not all our readers can handle this chip, but I give herewith a life-size picture of it which will give a good idea of what it is like. Its dimensions can be measured from the engraving; the feed was 3 per inch; there were two carriages on the lathe, and the other carriage was taking a similar cut at the same time. The chip weighs 11 ounces. Mr. Shanks informed me that he built similar lathes with four carriages, all of which would take a similar cut on a steel shaft, with a feed of 3 per inch. The appearance of one of these lathes is seen in Fig. 2, where it is shown as rigged up with the Barrows arrangement for turning the pins of crank-shafts. This lathe is quadruple geared, the final gear of the train being upon the face-plate, which is 11 feet diameter, and the gear, which is an external spur, is 109 inches diameter, 2¾ inches pitch. The carriages have all imaginable feed motions in every direction and, for turning, feeds are provided ranging from 20 revolutions to 1 revolution per inch. The splined shaft running along the front of the bed gives the motion for the various feeds of the rests, and these can be changed without altering the feed of the carriage upon the bed. The lead-screws are of steel, 3 inches diameter, are reversible by clutches and levers, and have a rapid traversing motion of about 5 feet per minute.

It will be noticed that the bed of the lathe is double, and that the front and rear carriages are so arranged that they will pass each other, and I think, though I am not sure of it, that the rear projecting portions of the carriages are arranged to pass under the foot-stock, thus permitting the latter to be brought up very close when short work is to be dealt with, which short work, as we know, may require as heavy cuts to be removed from it as longer work, and consequently may need to be just as well supported. The saddles can be firmly clamped to the bed, and the upper rests then used with feeds in any required direction.

The head-stock has a base 8 feet wide and 7 feet long; the main spindle is of steel, with a front journal 16 inches diameter, 20 inches long, and both journals run in gun metal bearings having flat bottoms.

The crank-pin turning arrangement will be readily understood from the engraving. It consists essentially of a four-jawed chuck, which can be clamped to the main face-plate at any required distance from the center, and which is designed to grip and hold one of the flanges of the shaft; a rest applied near the cut and an arm to be clamped to the other flange of the shaft, and having a sliding block, in which is the center upon which the shaft turns. The rest referred to turns with the work, and is provided with three sliding jaws, which are run up onto the crank, as shown near the pin, and if desired two other jaws, which are not in place in the picture, may be applied to the crank near the shaft. The bracket which supports the outer end of the tool has a small rest fitted to it, which rest is not moved independently, but is simply connected to the main rest by the tool itself.

I have every reason to believe that this

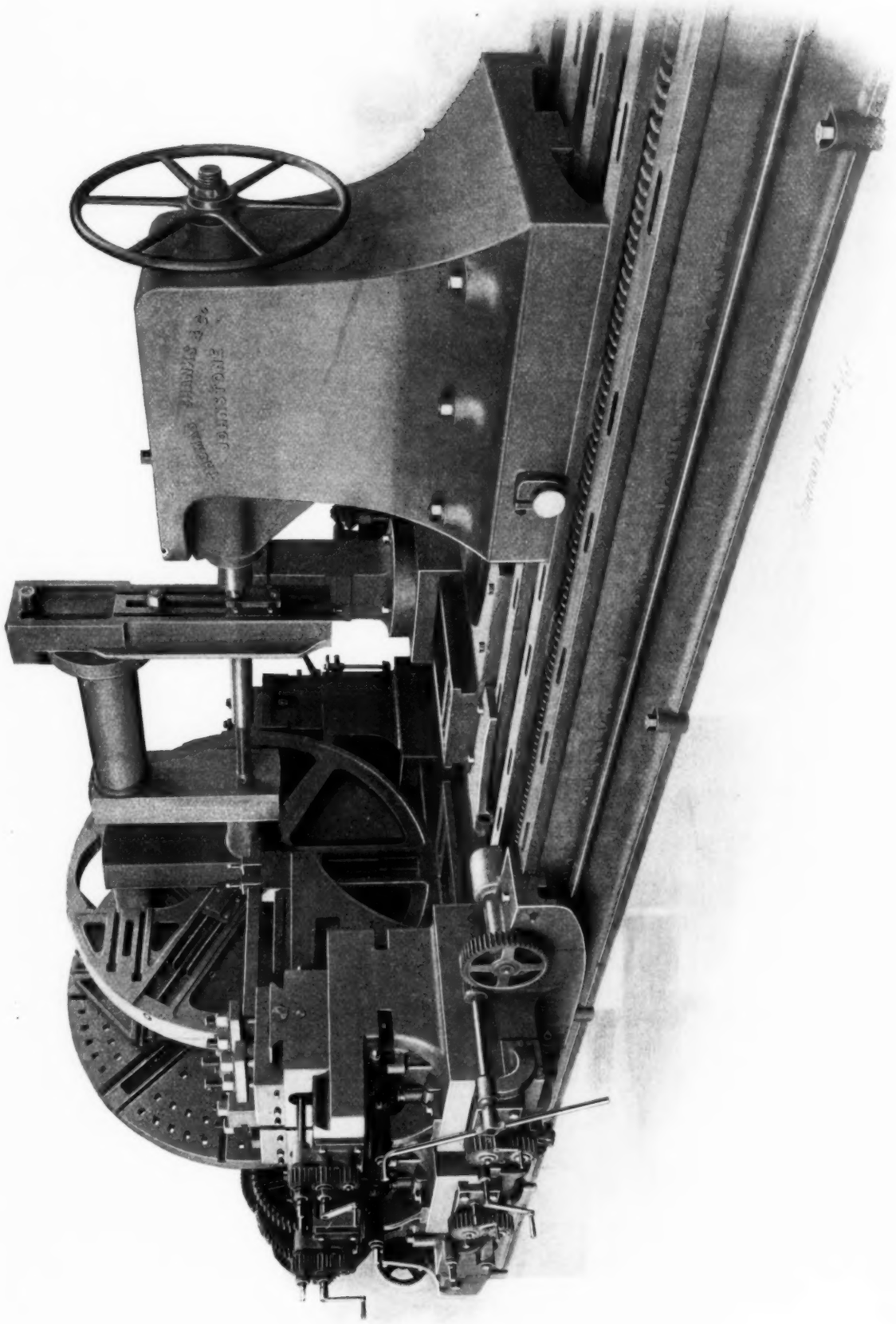

FIG. 2.—A HEAVY SCOTCH LATHE.

is a very efficient tool; I cannot persuade myself that it is a handsome one, nor that it would not be easy to make it look better without sacrificing its efficiency in the least. The foot-stock is, I believe, peculiar to this builder. I do not know why it is made in that shape, and must confess myself unable to guess at a reason. In the case of so large a lathe built here we would consider it necessary to put on a gear-wheel in place of the large hand-wheel and carry a shaft forward to a hand-wheel located nearer the center. But in every other respect I believe the lathe is quite conveniently arranged.

Fig. 3 is a view of a tool, which, so far as I know, we have no counterpart of here. It resembles the wall planer, but is self-contained, and is used in the neighborhood of the Clyde for finishing heavy forgings, such as solid or built-up cranks, connecting rods, stern posts, etc., and for slotting key-ways in propellers and large wheels. The platen has a traversing feed motion in one direction only, the lateral motion of the saddle above giving the feed motion in the other direction. The platen has a rotary feed motion, however. The tool-carrying saddle slides in a vertical slide-bed, which may be adjusted to any required hight by power, and either the lateral or the vertical motion may be the cutting one, the other being at the same time for the feed, as may be required. Work 9 feet wide and 4½ feet high will pass through between the housings of the machine shown.

I have before referred to the striking appearance of the shop in which these tools are built, and to the fact that when it was planned Mr. Shanks determined to have it so that there would be no longer any necessity for erecting tools in any other than the upright position in which they were intended to work; a necessity which had often presented itself in the old shop. Fig. 4 is an internal view of a portion of the machine shop. It is 400 feet long, 70 feet wide and 35

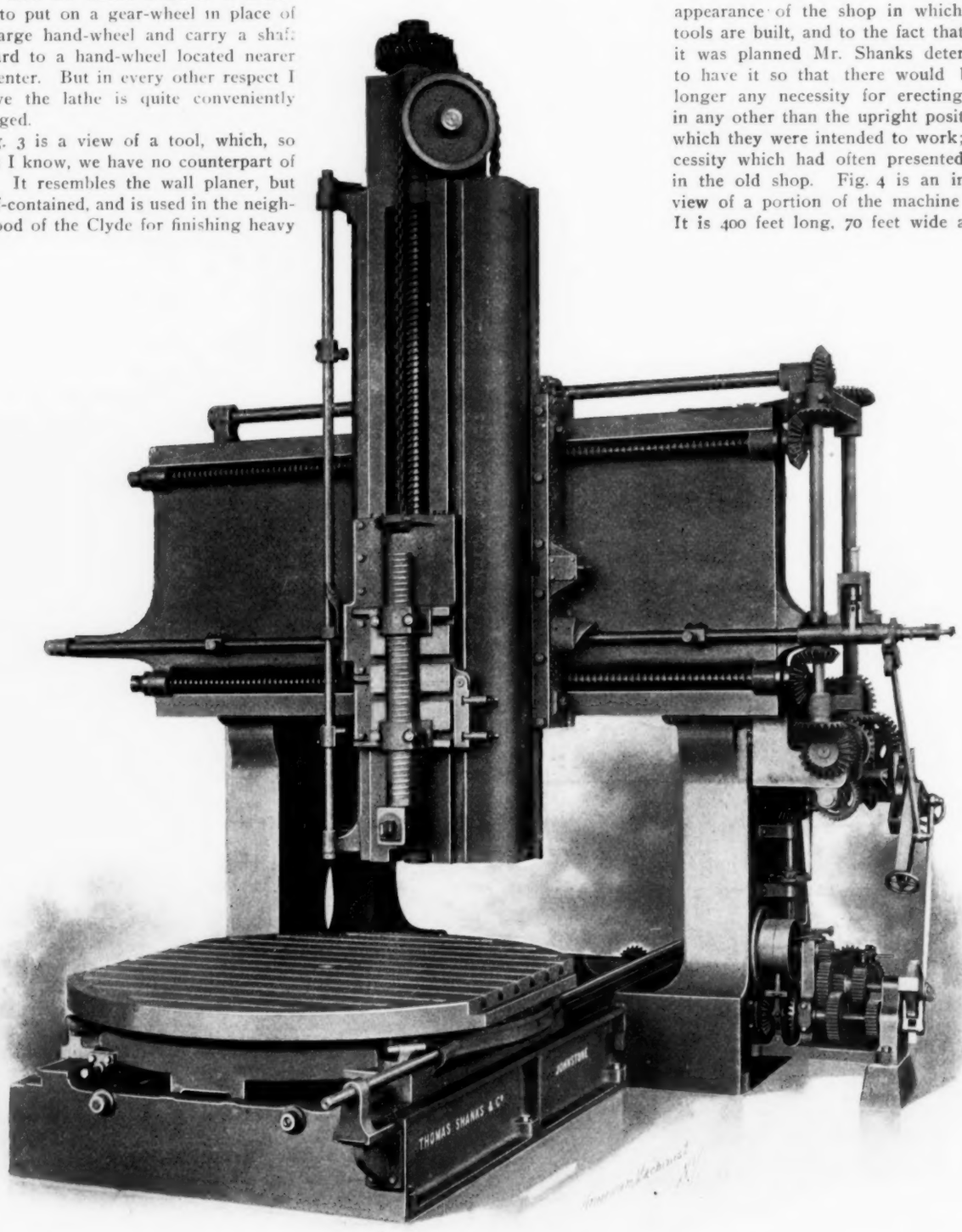

FIG. 3.—A PLANING MACHINE.

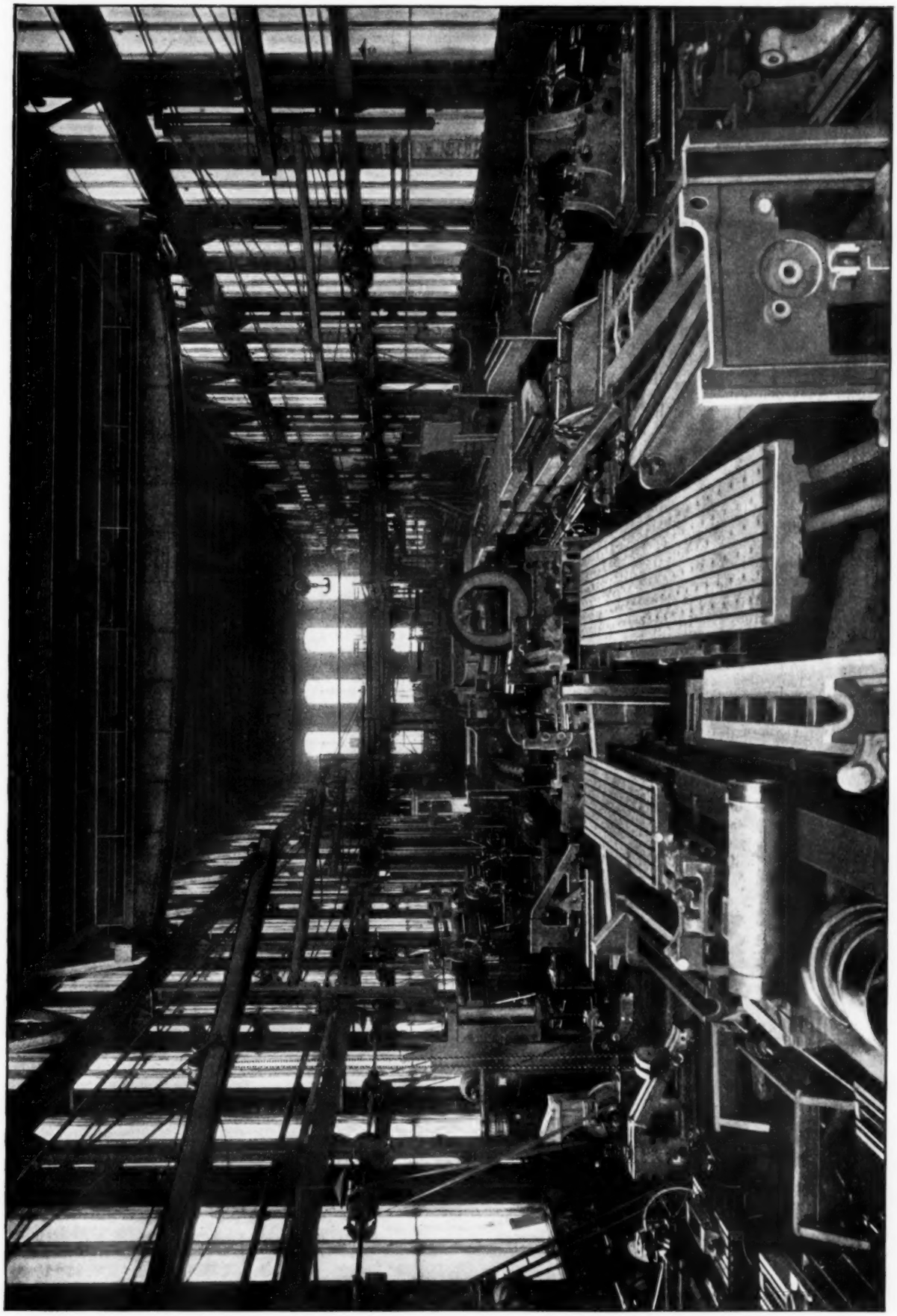

FIG. 4.—INTERIOR VIEW OF THOS. SHANKS & CO.'S MACHINE SHOP AT JOHNSTONE, SCOTLAND.

feet high under the crane, and every inch of this room has at times been needed for the erection of tools, the Shanks work having tended toward larger and heavier sizes during late years, the same as has been the case with our American heavy tool builders. The very tall windows not only give a liberal supply of light in this shop, but outside, where they seem even taller because not crossed by anything which breaks up their continuity, they give the building a very striking appearance. F. J. M.

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Letters from Practical Men.

Annealed Steel.

Editor American Machinist:

In the "American Machinist" of January 27 last, in the article on "Annealing Steel," by Mr. F. A. Pratt, of Hartford, I find much that is interesting to me.

Upon several occasions I have run up against this too much annealed steel. I can remember when it was impossible to buy it, and I have very often since then wished it was so still.

I used to wonder in those days why the steel makers, who had every facility for doing this annealing and ought to know how to do it better than anyone else, did not do so, and by charging a little more relieve the users of their product of a rather uncertain and disagreeable job.

We were in those days always wanting something "right off," and couldn't wait to anneal a piece, so there were frequent trips to the grindstone, and if there was a thread to be cut a little flowery conversation with the lathe-tool. Well, pretty soon along came annealed steel, with its special label and dead black color, that looked so nice and soft you hardly dared to pick up a bar for fear it would double up.

Some of it worked all right, and was at once hailed as a boon and a blessing, but after a time there was trouble about its hardening, and it didn't cut right.

I remember a case in point, a well-known English steel. It wouldn't harden any more than iron. I had some special taps to make. I could *not* cut a smooth thread. I laid it to everything but the steel. I pulled the lathe down, tried different tools hardened and drawn to every color in the rainbow. I even thought of getting a spectroscope to see if I couldn't spy out a new color. No use. I would start the thread all right, and as long as I carried a fairly heavy chip I had no trouble, but when sharpening up for the final cut, when we like to see those two little thin shavings come curling up from each lip of the tool and pile up like a snarl of hairs, that's when they didn't come, but instead chuck would go the tool into the thread and roll off a lot of dough, leaving a surface that would cause a man to almost think out loud things that are better left unsaid. I had no trouble at this time with machine steel or cast iron; could cut a good thread in either of them, and finally it began to dawn upon me that there was something wrong with the steel. In hardening it, no matter how careful I was in heating or how cold the water was, even salt water had no effect on it. I tried a charcoal fire. It was no better. Then I took some unannealed steel, annealed it in air-slacked lime after carefully heating, and had no trouble at all. It hardened all right. The agent of the manufacturers came on, looked the matter over, asked a good many questions, but didn't answer any, took back a lot of the steel and sent another lot in its place. This was some better, but not much. I have seen machine steel that was also too soft. I remember a lot of knitting machine cylinders made from round machine steel. The thin cutters used for cutting the needle grooves broke and cut the grooves crooked. The small drills used on the cylinders, about 1-16 inch in diameter, broke in the stock, and it was an endless job digging them out. The steel was too soft, and when a different grade was tried the trouble disappeared. But those thin grooves are milled a great deal better with the feed traveling with the cutter than against it. You must either use a weight to hold back the table against the screw or gib it up pretty tight so the cutter can't draw into the work. But that's the way to cut them, and the cutter is not near as apt to run.

I used to think steel could not be too soft. I think I know better now, and unless I have some annealed steel I am sure of I take a piece of unannealed steel and anneal it myself. I used to make a good many heading dies for pin-setting machinery, and the steel I annealed in an iron box the blacksmith made for me, with a cover. I packed the steel in layers of cast-iron chips and heated it in a charcoal furnace, leaving it in the ashes until the next morning. I never had any trouble from that steel. I believe steel makers can make the steel right. I never heard of any, or at least very little, trouble from drill rod. I have made many taps from it and never had the least trouble either in cutting the thread or hardening, and I know that immense quantities of it are used, and it *must* give satisfaction. I never had had the least trouble with it as either too hard or too soft. I never have had to anneal a piece or have lost it on account of failing to harden. This seems to prove that the steel can be made right.

I have been troubled by the uncertain qualities of machine steel in hardening, or, perhaps, more properly in case hardening. I had a lot of screws to case harden of supposed machine steel. So I used cyanide, and the heads flew off like glass ones when the screwdriver was used on them—half-inch screws at that. I tried hardening some without cyanide. They hardened exactly like tool steel, and it *was* tool steel as far as I could see. What a good many of us want is tool steel that is annealed so it will harden all right and cut smooth, and the fellows that want dough, why, let them have dough, but tool makers need steel. MACHINIST.

Springfield, Mass.

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Whitewash and Success.

Editor American Machinist:

Who can tell why success and whitewash are always found together in a machine shop. That this is true no one need dispute, but whether success brings whitewash or whitewash brings success may be a question. Five of the ten shops in which I have been employed were neatly whitewashed and making money. The other five scorned whitewash and sunk their owners' money. I dropped into a shop the other day that I think must either whitewash or quit soon. A low ceiling, black with dust; windows grimy. Over in the dark corner at the big lathe sat an old-timer enjoying his after-dinner pipe and eyeing with evident satisfaction the slowly advancing tool. Over all shone the yellow rays of a huge dash lamp, which stood on a box at his side. Time, 2 P. M. Even in this age of low prices what is cheaper than daylight? And yet hundreds of men are groping in half-dark shops simply because the managers will not wash the windows and brighten up the walls. There is magic in whitewash for you, proprietors of dingy shops and factories. Try it, and see how much better the men will appear, and if a visitor drops in he will go away with a good word for your shop, which may bring you more business. LIGHT UP.

Des Moines, Ia.

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Making a Helical Pattern.

Editor American Machinist:

A description of the making of helical-conveyor flight patterns may be of interest to some of your readers. Some years ago Mr. D. S. Dingley described in your columns a way of making propeller wheels, and while the surfaces of both are the same mathematically, the details of construction are very different. Taking the outside diameter as 48 inches, inside diameter 36 inches, advance or pitch 26 inches in one turn, and the segment to be one-fourth of a circle, we have the data with which to commence operations. Have a heavy drafting board, large enough for the purpose, and made as near perfectly flat as possible, and thereon with radii of 18 inches and 24 inches respectively strike

the concentric arcs *A B* and *C D* and draw radial lines 1 and 7 subtending one-fourth of a circle, as shown in Fig. 1. Divide these arcs into any number of equal parts, as six, by the radial lines 1 to 7. These lines should be made on the board with a sharp knife, and should extend outside the arcs, as shown. Now

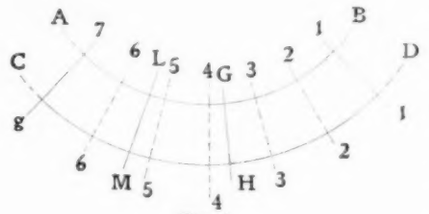

Fig. 1

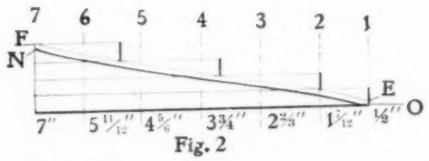

Fig. 2

Fig. 3

LAYING OUT THE HELIX.

get out to the exact dimensions given above a segment of suitable material and of any convenient thickness; in this case I have selected 1¾ inch. This segment should be dressed perfectly flat and of uniform thickness, having the ends trimmed radially. Lay the segment on the board coinciding with the lines laid down, scribe vertical lines 2, 3, etc., as in Fig. 2, on both inside and outside surfaces of the segment. These lines are ordinates of the curve, and the lengths of them must now be determined. As the helix advances 26 inches in one turn, in 90 degrees it would advance 6½ inches, and as the arcs are divided into six equal parts each ordinate will advance one-sixth of 6½ inches, or 1 1-12 inch. Assuming the pattern to be ½ inch thick, the length of the first ordinate to the line *F E* would be ½ inch, the next 1 7-12 inch, the next 2 2-3 inches and so on, as shown by the bottom figures in Fig. 2. The extreme hight of the pattern is 7 inches, and if the lumber were dressed full 1¾ inch, four courses will be required, and their respective lengths can now be taken directly from the first segment. All of the segments should be made to exact size and glued up in the shape shown in Fig. 2, the ends of each piece commencing in this case about on the lines 2-2 *G H* and *L M*, Fig. 1. When the whole has been glued up and such smoothing of the joints as is necessary has been done, it may be laid back on the board in the proper position, and the ordinates scribed entire (they having been marked on only the first course before) and their lengths laid off, as in Fig. 2.

Now take a strip of pine 1-16 inch thick and ½ inch wide, about 40 inches long, and spring it around through the points laid off and scribe lines *E F* and *N O*, on both inside and outside. Of course, the ordinates to the same radial lines will be of the same length. The laying out is now completed. If you have a good bandsaw and a sharp blade about 5/8 inch wide you can saw this surface out with a little care to within ⅛ inch or even less, for the generatrix of the surface is a right line perpendicular to the tangent plane, in this case the cutting edge of the saw being the line and the saw table the plane. An inspection of Fig. 4 will show this. It is necessary to keep the block tangent to the table at the cutting edge of the saw. I have done this a number of times, and have never had any trouble. After sawing off the portion above the line *E F*, finish to the lines, and if the pattern is of T-section, as shown in Fig. 3, glue on the required material for the flange and work it out to completion. Then saw out on line *N O* and finish as before.

With reasonable care the results, as to accuracy, will be most satisfactory. A

Fig. 4

SAWING THE HELIX.

pair of former blocks, of about the above dimensions, for forming T-shapes 3½ inches by 5 inches were made from one pattern, and when placed together fitted beautifully.

The pattern-maker might think that it would be easier and more economical to make the block from short pieces; that is, making both top and bottom like that portion above *E F*, but after trying both ways I find the one given here is much more convenient every way, and the time about the same.

A. L. BOWEN.

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Another Counterbore.

Editor American Machinist:

While we are talking about counterbores I hope that I may be permitted to say a word or two. That projecting key and chain on the counterbore shown February 3 has been jumped on enough, so I have nothing more to say about that. It is settled that it is one of the things to be avoided. Now, if I should get up and say that, in general, all the flat cutters shown in the various counterbores which have lately appeared in the "American Machinist" are also something to be avoided, I would be saying just about what I believe in the matter.

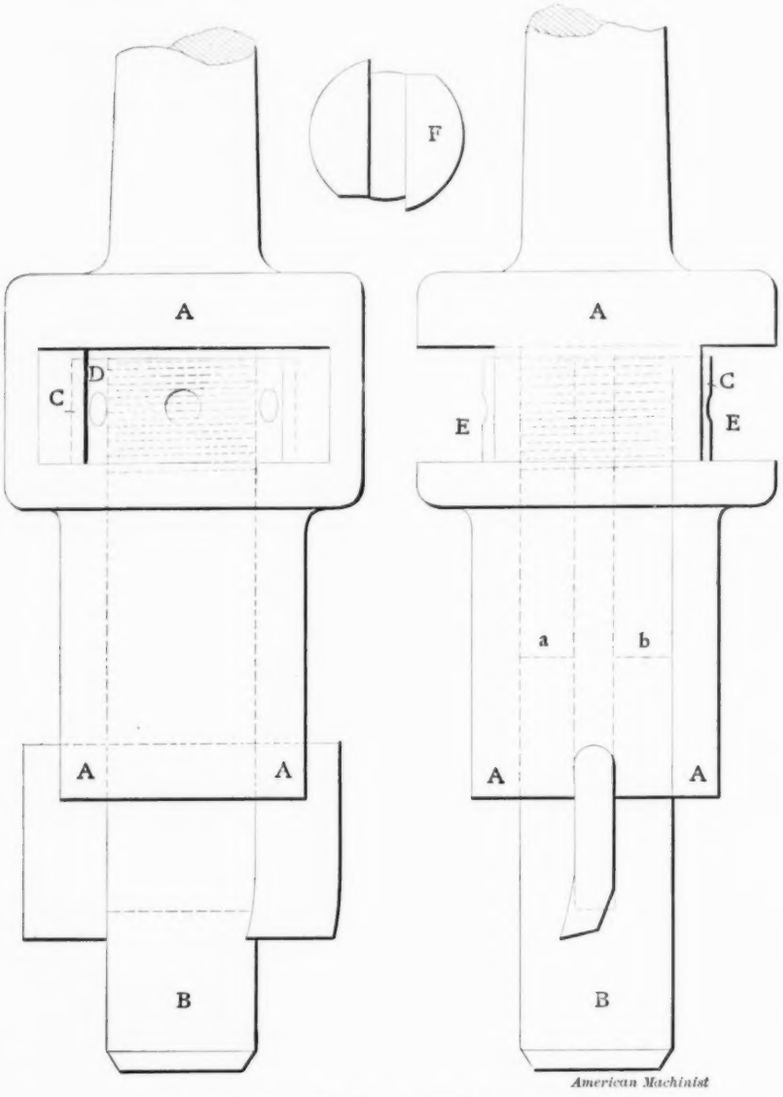
We all know well enough the difference there is between rubbing or pushing or scraping off the metal, or in cutting it off, and we all know how necessary is the acute cutting angle for the front of any cutting tool for iron or steel, in order to get the metal off smoothly and with the least expenditure of power, and in view of our knowledge of this fact, and of our long-winded discussions and explanations of it, is it not perfectly astonishing how tamely, all through the trade, the flat cutters for counterbores or boring bars have been accepted, and how widely they have been used?

The wide and continued use of flat cutters instead of lip cutters represents in the grand total an enormous loss; a loss of time and a loss of power, and in some cases a loss in the character of the results produced. Shops ought to start a "theory and practice account" as a place in which to bury the money that they might have made, like the profit and loss accounts of the bankers. The use of the flat cutter in these places is a case of practice versus theory, in which it is the practice that is in the wrong. We clearly do what we very well know we ought not to do, or we do not live up to our own theory as to cutting tools.

We have been slaves of the slot. Because we could not get a cutter with proper lips on it to go through the narrow slots in the boring bars, and in the combination counterbores that we have been inventing, we have just gone on sticking in the flat cutters, and the work has had to suffer. We know better than this all around; but as to our practice: Who is to cast the first stone? When we used to make the old solid counterbores we always used to insist upon filing a handsome lip to each cutting side of the cutter, and those old counterbores, as long as the edges were anywhere near sharp, used to roll out most beautiful chips. I believe I have never seen any slicker cutting done anywhere than can be done with a counterbore, if it only has proper lips to it. Flat cuts seem to be much more comfortable with drilling or boring tools than with outside turning tools. Nobody would ever think of setting the lip of a diamond-point lathe tool exactly square. The chips would roll and crowd against the work, and by reaction would bind hard on the cutting edge, and things generally would be anything but satisfactory. With a properly lipped counterbore we have easy cutting,

and the chips get away without trouble. The lip has practically the same cutting angle for the whole width of its cut, in which respect it is much better than the twist drill, which has not more than enough rake at the outer edge and diminishes to nothing at all at the middle.

I, of course, have not been talking all along here just for nothing. The above is merely my modest way of introducing the accompanying sketch, which is intended to suggest how a counterbore nut with a pin wrench tightens everything. Whenever it is necessary to take the cutter out to grind it or to change it the nut must be unscrewed clean off and *B* must be taken entirely out of the stock *A*. If the edge of the round nut *C* is milled it can be run around quite rapidly by the thumb and finger. As I have drawn it here the nut *C* would have to be flatted a little on two sides to get it through the slot *D*. It would probably be better to make the slot wide enough



COUNTERBORE WITH LIPPED CUTTERS.

may be made with a properly lipped cutter. The stock *A* has a straight hole bored up into it, and just below the taper shank it is enlarged to provide for a big cross slot *D* and the two side notches *E E*. The central piece *B* is turned to slip easily up into the stock and extends to about the top of the big round nut *C*. The upper end of *B* is threaded and the nut *C* fits easily on it. *B* is slotted all the way up to the top, so that the lipped cutter may be dropped down into it before it is put in place. Screwing up the to let the complete nut slip in. There should be a loose piece the same thickness as the cutter dropped into the slot on top of the cutter to keep the slot from closing under the angular thrust of the thread. Using a square thread would probably take care of that point.

Now this is only for a starter, and there is a chance at once for various suggestions in the way of improving it. Any of the usual arrangements may be adopted for securing changeable thimbles on the pilot end. If it is ever desirable to have this end much smaller than I have here shown it, the two forward corners of the central piece *B* may be cut off all the way down as shown at *F*, which is a section on line *a b*, to allow the lips of the cutter to clear as they slip down. This invention is a failure in one respect. It does not suggest any means of preventing the slipping in of the plain flat cutters if anyone insists upon doing so. If people still persist in using the flat cutters when they know they ought not to I am not to blame.

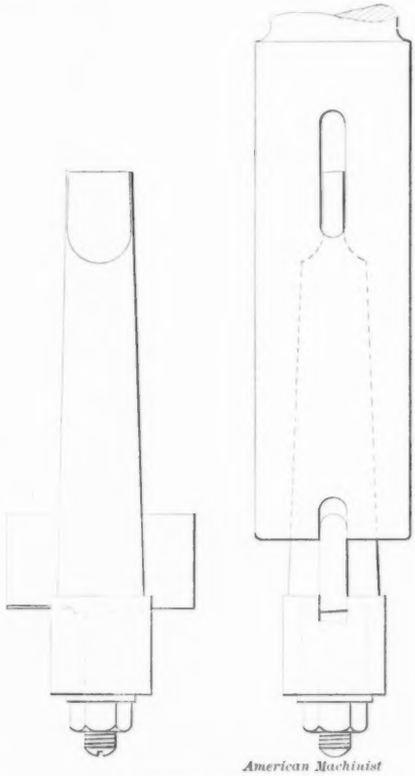
TECUMSEH SWIFT.

▲ ▲ ▲

Another Counterbore.

Editor American Machinist:

I have read with interest, as I always do, your last issue, February 3, and notice the counterbore illustrated with key and chain, and note your remarks. How anybody can use such a thing and hope to escape the laws on "Employers' liability for accident to employés" passes my comprehension. I inclose sketch and description of a counterbore invented by me many years ago—no patent—and we have made them with blades 6 inches long. Please note that these counterbores can be fitted to the ordinary drill



A COUNTERBORE.

socket by slotting the end of the socket to straddle the cutter.

J. D. COX, JR.

Cleveland, Ohio.

The description to which our correspondent refers above seems to be scarce-

ly needed. The cutter is held in place by the central screw at the bottom, the point of the screw fitting into a drilled center in the middle of the cutter. This screw also serves as a stud for the nut which secures the changeable bushings or thimbles on the entering end of the counterbore. This tool may not be new to all of our readers, as it is made by the Cleveland Twist Drill Company.—ED.]

▲ ▲ ▲

Confining a Lathe Tool-Post Pin.

Editor American Machinist:

One of the aggravating things to me in connection with a bench lathe is the manner in which the pin for turning the binding screw in the tool-post will rattle out and roll and roll until it finds a crack in the floor or some other hiding place to sneak into and secrete itself. The celerity with which one of these pins will get out of the way the moment it touches the floor is something surprising. They generally rattle out right under your nose, but your attention is given so closely to the square or hex piece you are turning and the noise of the tool on the work deadens the sound of its fall to such an extent that the rascal has time to cast a hasty glance about, select some convenient hiding place and deposit itself therein before you think of looking for it or have even missed it. After making one or two ineffectual grabs at the place where it ought to be, with your attention mainly upon the tool, which needs a little doctoring for position, you realize the fact that this nomad has again started upon a tour, and also that if you want it you will have to hunt for it.

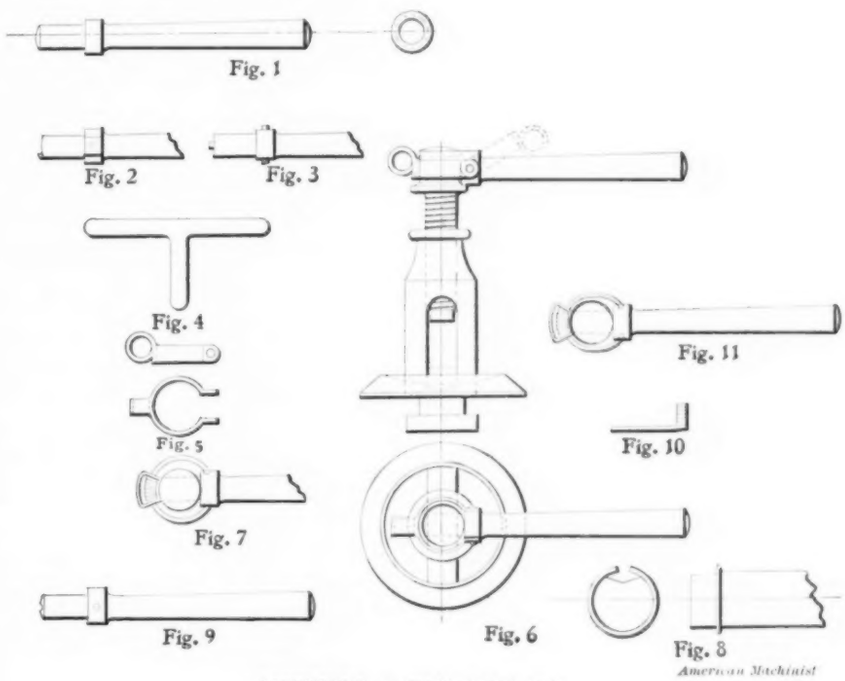
The picture of this nomadic genius appears in Fig. 1. Confining the pin within a split chuck and placing it in the milling fixture of a bench lathe, with a small hollow mill, I slabbed off two flat places opposite each other on the shoulder, as shown at Figs. 2 and 3, leaving a round, pin-like projection on either side. A piece of sheet steel was then cut, like Fig. 4, bent like Fig. 5, and drilled to fit the pin projections on the tool-post pin. After hardening in oil and blazing off twice it was snapped upon the projections, which were riveted over slightly, securing the lock ring upon the pin, the end of which was filed, as shown at Figs. 2 and 3, making a stop for the ring when pressing it down over the end of tool-post screw head.

Fig. 6 gives two views of tool-post, with pin inserted, showing ring in positions to either lock or allow of the removal of pin.

The ring should move with sufficient ease so it can be raised and lowered with the forefinger of the hand used in removing or replacing the pin.

Later I made another ring similar to those used in the stem of watches, as shown in Figs. 7 and 11. In one case the ring is left round and in the other slightly flattened.

I made the rings by winding a coil or two of piano wire on a mandrel, cutting the rings off and placing in the vise on a round piece, with a place chipped out, as shown at Fig. 8, into which the ends are hammered. The V-shaped recess chipped out allows the ends of the wire, which is quite stiff, to be hammered down far enough to bring them about right when they spring back, as they will do some. They are then cut to proper length. Two shallow holes are drilled in the shoulders of the pin opposite each other, a slight notch is filed in the end of pin, as shown in Fig. 9 at *a*, for a small piece of coiled wire to rest in, wound, as shown at Fig. 10, and slipped upon the ring, the long end being bent and turned around the ring, as shown at Figs. 7 and 11, forming a small projection for convenience in raising. It is soft soldered to the ring when complete. Care should be taken, as noted before, not to have the notch in the end of the pin so deep or the wire of which the ring is made so stiff as to require much force to raise the ring.



CONFINING A TOOL-POST PIN.

I trust this may add to the comfort of some others who have suffered as I have and aid in keeping at home an important part of the lathe, whose ingenuity in escaping from the responsibilities of its position seems almost human.

MACHINIST.

▲ ▲ ▲

Halation in Shop Photographs.

Editor American Machinist:

In a letter from Brioschi, Finzi & Co., published by you in the issue of February 3, they call attention to a backing for the sensitive plate to prevent halation. Any oily substance, it seems to me, must be bad, and not nearly so good or sensible as the old way of using an opaque paint that is readily soluble in water. Oil on the plate must be hard to remove. The best way, I think, is to buy plates made to do just this line of work; they cost very little more than the ordinary plate. Properly timed exposure will then give you a plate as fine as one could desire. These can be bought of any maker of standard plates.

HOWARD P. FAIRFIELD.

Cleveland, Ohio.

▲ ▲ ▲

Squaring-Up Gage.

Editor American Machinist:

I question the advisability of using the "Squaring-Up Gage" submitted by "H. L. C." in your issue of February 10, for I doubt its accuracy for the purpose there specified. This was tried several years ago in our own shop and found to prove as above stated.

The tracks and edge of the shear of a lathe bed are planed practically parallel, but after the ways are scraped and the carriage "seated" the ways will in most cases be slightly out of line with said edge, and, therefore, it will not do to depend upon this edge to square up the carriage, but we must depend upon something that is in line with the tracks. In our shop we use a swinging point attached to the spindle of a headstock, and square up the carriage in that way. It has proved to be as quick and a far more accurate method than the other.

G. D. C.

Fitchburg, Mass.

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The American Merchant Marine.

To our mind the item published in our issue of February 17, to the effect that a contract for the first American built tramp steamship had been placed, is the most significant that has recently appeared, as indicating the early rehabilitation of the American merchant marine.

There is, and has been for years, a loud call for subsidies for American steamship lines to compete with the so stated subsidized lines of foreign builders. It is well known that tramp steamers, as well as many lines of regular packets, are not subsidized, and the fact that the building of tramp steamers has begun in this country is certainly indicative that subsidies are unnecessary.

It is the custom among the ignorant in such matters to despise the tramp steamship. It would be just as reasonable to despise the freight train. The fact is that the ocean-carrying trade is done by these despised tramps, and not by the "Lucanias" or the "Majestics." The latter fill the public eye, as do the luxurious limited railroad trains; but the former have about the same economic importance in comparison with tramp steamers that the latter have in comparison with the freight trains of the country. To develop our foreign trade it is not steamers of the luxurious class we want, but tramps which carry freight wherever it is wanted, and at low rates. This may not gratify our pride, but it is nevertheless a fact.

It has been an opinion of ours, which has grown in strength with the development of the foreign trade in American built machinery, that the causes which have led to it are about to play a far more important part than any governmental action on the rehabiliation of our ocean carrying trade. We have not built ships for the reason that others could do it more cheaply, but with the development of labor-saving processes in all branches of manufacture, and especially with the cheapening of all forms of iron and steel, the time is at hand when these conditions will be reversed. Iron is undoubtedly made more cheaply in this country than anywhere else in the world, and the effect of this on steamship building cannot be otherwise than as we have stated. That the labor cost will be lower here may be taken for granted, for the same reason that it is lower on numerous lines of manufactures in iron which we are selling throughout the world. If, as is the fact, we can build locomotives cheaper than others, there is no apparent reason why we cannot do the same with steamships.

We believe that the industrial opportunities before this country are greater than ever before in its history, and our greatest wish is that the American people can be made to realize it. If the senseless chatter of the politicians could be quieted; if the various causes of uneasiness could be removed, and especially if the finances could be put on a satisfactory basis, nothing could prevent the realization of the outlook. Accident from one or more of these causes may prevent, but the underlying conditions favor an industrial expansion which no man can measure or estimate.

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What Is an Accident?

Shopmen, who may be said to dwell perpetually with the possibility of accidents, will naturally be interested in the legal definition of an accident which was recently rendered by a judge of the United States Court of Appeals in a case wherein an accident insurance company was sued by the widow of a man who had died from the effects of blood-poisoning resulting from an abrasion of the skin upon a toe, caused by a tight shoe. The insurance company claimed that this was not an accident. The court held that it was an accident, and gave the following definition of an accident: "What is not the result of design or prearrangement is accidental. No man intentionally wears the skin off his toes, and such injury must be considered accidental."

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On many accounts it seems desirable that a bill unanimously recommended by the Senate Committee on Education and Labor, and introduced by Senator Kyle, should become law. It provides for the arbitration of disputes between railroad companies and their employés likely to lead to labor troubles by a board of arbitrators, to be chosen by the strikers and by the Interstate Commerce Commission. The bill is recommended by the commission and has the support of trainmen. It is expected that if it passes it will put an end to railroad strikes.

Our columns are quoting pig iron as low as $10 per ton. Some fine drawn steel wire is worth $8,600 per ton, some pinion wire is worth as high as $43,000 per ton; hairsprings at only 1½ cents apiece are worth $400,000 per ton; the barbed instruments used by dentists for extracting nerves from teeth represent a value of $2,150,000 per ton, which makes "worth its weight in gold" a very weak expression.

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Questions and Answers.

Name and address of writer must accompany every question. Questions must pertain to our specialties and be of general interest. We cannot undertake to answer questions by mail.

(16) W. G. S. Sherbrooke, asks: Can you tell me of any stamp, either rubber or metallic, which will make a good impression upon the glazed side of tracing paper, such impression to come out fairly well in a blue print? It seems to me that success of this class of stamping depends more upon the ink than the stamp. If you can give me a formula for ink I should like to have it. If such outfits can be purchased I should like the address of parties furnishing same. A.—Tracing cloth or paper may be printed upon either side, from metal type much better than from rubber stamps. Use quick-drying, heavy-bodied printers' ink, such as a wood-cut or half-tone ink, with a little drier mixed with it, as the tracing cloth is non-absorbent and the ink dries slowly. This ink may be had in small tubes from Charles Hellmuth, 379 Pearl street, New York City. Apply the ink with a composition hand roller, which may be had at any printers' supply store. Squeeze a little ink on a glass plate and spread until the ink is evenly distributed on the roller, touch the type to the roller and print onto the cloth by hand, one or two letters at a time, since the strength of the fingers is not sufficient to impress many characters at once. A small printing press will do this more conveniently. After printing powder the ink with whiting or chalk to absorb the oil and thus aid in drying, also to increase the density of the ink. See also "American Machinist" for December 3, 1896.

(17) R. D., Philadelphia, says: Please give the proper weight for the flywheel for an engine with 18x24 inch cylinder, 135 revolutions per minute, throttling governor, boiler pressure 90 pounds, developing 175 horse-power.

Present wheel is 10 feet diameter, weighs 5,000 pounds and is too light. The engine drives wood-working machinery. Also, if you can, give us a rule that will at least give approximate results. One rule I have gives 3,500 pounds as the proper weight, while another gives 20,000 pounds. A.—The rules for fly-wheels are as numerous as the builders of engines and the writers on the subject. The mathematical principles entering into the question are well understood, but the trouble is a constant for the degree of fluctuation to be allowed enters the formula, and very little accurate knowledge exists regarding the value of this constant for different classes of work. The best treatment of this subject of which we have any knowledge was published in our columns September 7 and 14, 1893, by Emil Theiss, the resulting formula being:

$$W = i \frac{d \times I H P}{v^2 \times n}$$

in which

W = weight of rim in pounds;
i = a coefficient depending on point of cut-off and piston speed;
d = the coefficient of steadiness (being the constant mentioned above);
$I H P$ = indicated horse-power;
n = velocity of rim in feet per second;
n = number of revolutions per minute.

Assuming your point of cut-off to be at half-stroke, the value of i, according to the tables of Mr. Theiss, is

$$i = 170000.$$

For your class of work we should judge that a suitable value for d would be

$$d = 50.$$

We have also

$$v = 47;$$
$$n = 90;$$
$$I H P = 175.$$

Substituting these values gives:

$$W = 170000 \frac{50 \times 175}{2200 \times 90}$$
$$= 7500 \text{ pounds for the rim.}$$

This would give nearly 10,000 pounds for the entire wheel and we should aim at that figure. We are acquainted with a line of 18x30 engines which have 12,000-pound wheels and they have given excellent results.

▲ ▲ ▲

A Machinery Merchant from Amsterdam.

Mr. Th. H. M. de Grys, a member of the firm of P. C. Muller & Co., of Amsterdam, Holland, called at this office a few days ago. His firm has for some years past been doing considerable business in the importation of American machine tools to Holland, and the present indications are that this business is likely to increase.

Mr. de Grys intends to remain in this country for several months, and it is his intention to go into the shops of some of the firms for whom he has been selling, and more thoroughly familiarize himself with our tools, their capabilities and the best methods of handling them.

As our visitor resides in Amsterdam it was but natural that we should ask him something of the noted Amsterdam swindlers, a list of whom we published some years ago, and who have more recently been given additional publicity by the Association of Manufacturers. Mr. de Grys says he does not know that these rascals are more numerous in Amsterdam than in other cities of equal commercial importance, but is emphatic in the statement that American manufacturers should in every case fill orders only after thoroughly satisfying themselves that they are consigning to reputable and honest merchants.

The growth of the trade in American machine tools is attributed by Mr. de Grys to two causes, *i. e.*, the fact that in many cases English and German builders, who have until recently commanded the market in Holland, are now unable to fill orders in some cases within twelve months, and the superiority of our tools, which, he says, enables more work to be turned out with them.

▲ ▲ ▲

Personal.

Mr. Frank E. Shepard has been appointed superintendent of the Denver Engineering Works, Denver, Col.

Kindly oblige us by sending in personal items regarding changes of foremen, superintendents and others prominently conected with the machine business.

Mr. W. A. Warman, until recently with the Spaulding Machine Screw Company, of Buffalo, N. Y., has severed his connection with that firm to take charge of the machine and tool work of the Ritter Dental Manufacturing Company, of Rochester, N. Y.

Robert Allison, of Port Carbon, Pa., has retired from business. He began in the machine shop in 1845, and has been proprietor of the Franklin Iron Works, at Port Carbon, for thirty-seven years. The business passes into the hands of C. R. Allison, W. H. Brennan and F. C. Allison.

▲ ▲ ▲

Machine Shop Cost Keeping.

Editor American Machinist:

Under the above heading in your issue of January 6, Mr. Lucius B. Morgan makes a number of pertinent remarks in regard to my paper on "An Accurate Cost Keeping System," read before the American Society of Mechanical Engineers at their recent meeting in New York city. It was with the object of eliciting as much discussion as possible that the paper was written, and I am glad that it has received further attention in your columns, as it is only through such mediums that we can hope to enlarge our store of knowledge upon this important subject.

The first objection advanced by Mr. Morgan is to the effect that "real accuracy" as to the cost of any one item of product is impracticable, and that only "substantially accurate" results are possible by any cost-keeping system. In this belief we are fully in accordance, as no one experienced in this branch of shop management could well be of different opinion. My selection of title is doubtless responsible for this criticism, as it will be seen from a review of the paper that no attempt was made to show a method for obtaining "real accuracy" as to the cost of any one item of product, but rather how to obtain "real accuracy" as to the cost of a product considered as a whole; and, what I considered and still believe to be an improved method for obtaining "substantially accurate" results on each item forming a part of that product.

The point made by Mr. Halsey that office, or selling, expense should not be included as part of manufacturing cost struck me, at first, as being well taken, just as it did Mr. Morgan; and, upon returning from the meeting, I set about revising my general expense report. I had not gone very far, however, before I reached the conclusion that such a division would add little to the accuracy of our figures, while it nearly doubled the amount of labor involved in finding the cost of work on each order. To my mind there are but two factors with which we have to deal. The first is composed of all those items of general expense which must be charged off the books each month, as possessing no marketable value, such as rent, power, taxes, insurance, etc. The second is made up of everything that appears on the inventory, upon which interest and depreciation should be charged. To make my meaning more clear let us group our several items of expense under the three headings subject to discussion, *i. e.*, New Assets, Selling Expense and Manufacturing Expense, and assume that the amounts affixed represent the cost of each for a certain month—say June. By adding the cost of productive labor to the sum of the amounts disbursed for the several items under each of the three headings, we find that $7,700 has been expended during the month. Of this sum only $3,000 went into work for which there is any compensation. Hence it is obvious that the returns from this amount of work must be sufficient to cover the $3,000 paid in wages, plus the sum of all other outlays consumed in producing that work. The items from A to H, inclusive, are merely subject to wear and tear, consequently interest and depreciation for the remaining months of the year is all that we need to provide for in this group. The items from I to L, however, may be considered as being entirely consumed, and must be fully paid for each month. It is only upon these last items, therefore, that we should base our figures of general expense, which brings us to the consideration as to whether or not there should be a third

classification, *i. e.*, a separation of the letters from I to O from those of P to L, as suggested by Mr. Halsey.

We have seen that, to make expenses, we must receive $6,000 for the month's work. What proportion of this amount should be charged to each job? And upon what should our figures be based? For my part, I know of but two ways in which to arrive at anything like a fair distribution—either by the Hourly Burden plan, in which time and wages are used as factors; or by the Per Cent. Ratio plan, in which wages alone are considered. By the first we have 3,000÷15,000=.20 as the rate per hour to be added to the cost of wages on each job. In the second we have 3,000 ÷ 3,000 = 1.00 as the percentage by which the cost, in wages, of each job must be increased. The employment of either of these systems will make the manufacturer whole—not only substantially whole, but wholly whole—the question being, which of the two systems will give the greatest accuracy as to the cost of the individual job? Mr. Morgan says: "In regard to the Hourly Burden plan presented by Mr. Norris, it seems to me to be equally faulty with the Per Cent. of Productive Labor plan, which he condemns, for in both cases the distribution of general expense is based wholly on productive labor; the difference being that in one case hours and a uniform rate are used, and in the other dollars and a uniform per cent. I see no reason why one method should be considered more truly accurate than the other. The per cent. can be determined at regular intervals as well as the rate per hour." This last statement is entirely true, as we have seen in the foregoing, but I think a simple example will convince Mr. Morgan that the Hourly Burden, or "Wage-hour," system is more accurate than the Per Cent. Ratio plan.

A man and boy are working at the vise, side by side. The man receives 30 an hour and the boy 5. Between them they consume $4 worth of oil, waste, files, etc., which, let us assume, constitutes the total general expense for a day of ten hours. What should the manufacturer charge per hour for the work of each, figured by both methods, in order to make a profit of 10 per cent.?

(a) Hourly Burden = 4.00 ÷ .20 = .20 cts.
(b) Per Cent. Ratio = 4.00 ÷ 3.50 = 1.14 p. c.

(a)
.30 + .20 + 10 p. c. = .55 = charge for man's time.
.05 + .20 + 10 p. c. = .27 = charge for boy's time.
Total..... 82

(b)
.30 + (.30 × 1.14) + 10 p. c. = .71 = charge for man's time.
.05 + (.05 × 1.14) + 10 p. c. = .11 = charge for boy's time.
Total..... 82

It will be seen from the above, that while the second system of figuring accomplishes its mission so far as the ultimate results are concerned, it is manifestly inferior to the first plan, in which

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HOURLY BURDEN 20c. JUNE. 100 PER CENT. RATIO.

New Assets.	A	Standard drawings	100
	B	Standard patterns	200
	C	Standard machinery and tools	1,200
	D	Special tools, jigs and fixtures	100
	E	Line shafting and accessories	50
	F	Office and shop fixtures	25
	G	Belting	20
	H	Miscellaneous	5
		Total	1,700
Selling Expense.	I	Advertising	150
	J	Office supplies	50
	K	Traveling expenses	28
	L	Drayage, freight and expressage	60
	M	Boxing and crating	50
	N	Interest and discounts	12
	O	Bad debts and extras	50
		Total	400
Manufacturing Expense.	P	Official salaries	600
	Q	Rent, power, taxes and insurance	300
	R	Interest and deterioration	700
	S	Interest on new assets	51
	T	Patents and royalties	
	U	Light and heat	15
	V	Perishable tools	200
	W	Shop supplies	150
	X	Drawing room supplies	20
	Y	Non-productive labor	500
	Z	Miscellaneous	64
		Total	2,600
		Total general expense	3,000
		Total productive labor, 15,000 hours	3 000

COST STATEMENT.

Shop No. 1623. For JOHN SMITH & CO. Order No. 7845.

Week Ending.	Drawing Room. Hours.	Drawing Room. Amount.	Patterns. Amount.	Castings. Amount.	Stock. Amount.	Machine Shop. Hours.	Machine Shop. Amount.
Oct. 2	10½	$3 68					
" 9	30½	10.72	$11.25				
" 16	19½	6 85	39.00	$7.36	$43.69	7¾	$1.15
" 23	36½	12.81	30.65	.48	2 79	55	8:92
" 30						28¼	6.09
Total,	97	$34.06	$80.90	$7.84	$46.48	91	$16.16

Drawing room time	97	General expense	$33.84
Machine shop time	91	Drawings	34.06
		Patterns	80.90
Total time	188	Castings	7.84
Hourly burden	18	Stock	46.58
	1,504	Labor	16.16
	188	Cost	$219.28
General expense	$33.84		

Remarks: .....

expenses are made on every hour of labor, irrespective of the rate per hour of the workman—the loss incurred on the boy's time in the second plan not having to be made good by overcharging for the work done by the man. The boy occupies just as much space, requires the same amount of heat and light and consumes an equal quantity of oil, emery cloth, drills, etc., as the man, and should, therefore be charged with an equal share of the general expense which, alone, amounts to 9 cents an hour more than he is rated in the second plan.

It is quite true, as Mr. Morgan says, that the general expense may be very unfairly distributed by either method, but I think that all will agree that the "Hour-Wage" system is much to be preferred to the "Per Cent. Ratio" plan.

In the manufacture of very heavy machinery, such as produced by the company with which Mr. Morgan is identified, I think a separate tool charge adds much to the accuracy of the system, but for the average shop in which few tools are used whose cost exceeds $1,500, I know of no better way of finding costs than by the plan recommended.

Mr. Morgan remarks further: "Under the Hourly Burden plan, a machine or article made during prosperous times, when the hourly rate was low, would appear to cost much less than the same machine or article made in dull times, when the rate per hour would probably be high. Thus one might find himself with two machines exactly alike, in his storehouse, one appearing to have cost $500, the other $1,000." Precisely, it is to obtain such information as this that cost keeping systems are used. If a machine costs $500 more to build in dull times than it does in prosperous times we want to know it, and the best way to find it out is by determining the general expense each month by some such plan as illustrated in Fig. 1.

I am led to believe by some of Mr. Morgan's comments, that he has not read my paper with great care, or else that he has failed to fill in between lines, parts of the system having been described in outline only. He says: "Why not average or level up general expense over your entire unfinished product, as you proceed, instead of waiting until your product is finished and maintain the said unfinished product, so far as general expense is concerned, at practically the average to the present time, whatever the stage of progress?" This is exactly what is done by my system. If a machine is four months in course of building, and the general expense is calculated each month from the hourly burden, as recommended, the total general expense charged against the machine when finished will be the same as if figured from the total time and average hourly burden, from which it will be seen that the general expense levels itself up without the aid of any "clerical labor," whatever the stage of progress.

If you will kindly reproduce one of my cost statements I think little further need be said on the subject in this line, as the sheet is entirely self-explanatory; but before closing we must revert for a moment to the question of separating selling expense from that of manufacturing expense, the consideration of which we were obliged to leave temporarily in order to discuss the relative merits of the two systems.

If we had no means of determining, and comparing, the cost of our product other than provided for in the foregoing, I think much might be gained by separating office from shop expense, but by making use of the form shown in Fig. 8, of my paper, such a division seems entirely unnecessary, as no better means of comparing the cost of successive lots of machines can well be found than furnished by the information contained on these sheets. If Mr. Morgan's seventeen years' experience has taught him a better plan I hope he will let us have it in detail, but in so doing I trust he will refrain from any such simile as contained in his closing paragraph, which is neither well drawn nor to the point.

H. M. Norris,
Works Manager Bickford Drill and Tool Co., Cincinnati, Ohio.

[To prove the superiority of his Hourly Burden plan, Mr. Norris has assumed a man and a boy engaged on the same class of work. The defect of the argument is that this is not the usual condition of things—men as a class working on expensive tools and boys on cheap ones. Mr. Morgan's argument in favor of the Per Cent. Ratio plan was that it tends to equalize this condition—not with accuracy, of course, but at least roughly—while the Hourly Burden plan entirely ignores it. My contention that selling expenses should not be considered as a part of the cost of production, was expressly limited in its application to establishments in which the inventory value of manufactured goods on hand is in the aggregate a large percentage of the total assets. In a letter accompanying his manuscript Mr. Norris explains that the round figures given in his distribution of plant charges are merely intended to illustrate his plan.—F. A. H.]

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All our readers are by this time familiar with the story of the sad loss of life and of property by the blowing up of the U. S. armored cruiser "Maine" in the harbor of Havana. At this writing (19th) there is little to be said of it, except that the most likely theory of the cause of the disaster seems to have been the explosion of a magazine, caused by spontaneous combustion, and a fire in a contiguous coal bunker. Occurring at that particular time and place it was naturally open to many grave suspicions, which have been aggravated by sensation seeking and totally unscrupulous daily newspapers, which, however, happily for the peace and dignity of the country, have been very generally disbelieved and disregarded. A full and complete investigation may give us all the facts connected with the occurrence. Until it has been made and its results announced opinions must be founded upon rather hazardous guesswork.

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Commercial Review.

NEW YORK, Saturday Evening, Feb. 19, 1898.

MACHINE TOOL MARKET.

Flattering results continue to attend the efforts of sellers of iron-working machinery, and favorable indications continue to be revealed. "Broadening and deepening," "Better all along the line," "More trade all over," "More activity, more orders" are among the remarks which we have heard this week, each representing the opinion of a different house. Sellers are conservative, but contented. They do not meet a tidal wave of orders, nor a Bay of Fundy rise of them, but a gradual increase in the level of business, until it has now become deep enough to float a navy of manufacturing enterprises. From a comparison of the views of the various machine-tool houses in the Borough of Manhattan we think we can detect an improvement in the market within the short space of four weeks, since we last investigated it.

The effect of the termination of the engineers' strike in England is already being felt in the way of improved inquiry from that country and a better feeling, evincing a disposition to place orders. This has been noticed by several companies. One house is at present doing exceptionally well in its German trade, perhaps because of having taken more aggressive measures in that country of late. Another concern has contracts, now in part received and more to come in shortly, from a certain foreign company whose line of manufacture is conected with bicycle work. The orders will amount to some $15,000 or $20,000 probably, and will include a pretty considerable number of tools, as they are not to be of large sizes.

"Large tools are in better demand" is the report of one seller with whom large tools are a specialty. We inquired of a member of a firm which does make a specialty of heavy machinery whether the railroads were buying, and he replied that they were, although somewhat conservatively.

The stocks of a good many manufacturers of machine tools would seem to be pretty well sold out. This is the case with one of the largest New England companies. The secretary of a prominent local concern speaks of a paucity of stocks as, in his opinion, a general state of

affairs among tool builders, and another seller corroborates it. In conversation with the head of another house he cited to us incidentally the names of two or three concerns in Worcester who are busy, two or three more in Cincinnati, and one in Wilmington, Del. We hear elsewhere of other tool establishments in Cincinnati and one in Cleveland which are actively at work. Traveling men report business good at Pittsburg and Youngstown. One who has made a trip from Canada to West Virginia says that business lacks the snap which it displayed two months ago; that while there are many inquiries there is hesitancy in placing orders. But it seems to us that this is not a discouraging sign, because public confidence is so strong that if there is business in sight it is bound to come.

Prices are largely a function of lowness of stocks, and so many maufacturers are now so nearly sold out that a firmer tone is noticeable in figures quoted. "We are refusing an extra 2½ or 5 per cent. in some cases where we were formerly giving it," says the representative of one company, for instance. At the same time there are a number of unscrupulous parties in the market who are still perpetrating cruelties upon the poor, unoffending figures. One case complained of is where a seller has just been underbid 17 per cent. on a large tool worth several thousand dollars, the ratings of quality being the same, and the higher bid being somewhat a concession itself. Another illustration which occurred a few days ago is a difference of nearly 36 per cent. on a valuable lathe. This ought not so to be. It is a fact that the concessions made are apt to be upon large tools because they do not sell with the alacrity of small ones, and hence some of the most important companies are among those who make the low quotations.

It is not always the high prices which are most profitable to the middle man. The chief of a local sales house informs us that he can generally make better margins when prices are low. He also finds it less profitable to take contracts for large equipments than smaller orders, because the former are apt to necessitate the purchase of some tools, upon which little or nothing can be realized, to round out the specifications.

A local house has sold, this week, more than $12,000 worth of machinists' tools for shipment to Yokohama. They are for use in a shop now being built, for which almost the entire machinery equipment has been purchased in America.

DECEMBER EXPORT STATISTICS.

Exports of metal-working machinery for December, 1807, amounted to $452,043, and for the half year ending with December, $2,040,888. The figures for November, 1897, had previously been reported, $360,329. Electrical machinery exports were $255,872 for December, $917,453 for the half year, $171,668 for November. Pumps and pumping machinery, $178,400 for December, $955,334 for the half year, $138,044 for November. Shoe machinery, $81,918 for December, $405,252 for the half year, $55,732 for November.

Exports of other lines of machinery which, having been separately stated for a longer time, permit of a more extended comparison, included: Locomotive engines, $140,782 for December, 1897; $121,440 for December, 1896; $167,983 for November, 1897; $3,055,842 for the year 1897; $2,980,278 for the year 1896. The figures up n stationary engines were: For December, 1897, $26,955; December, 1896, $39,894; November, 1897, $21,136; year 1897, $359,698; year 1896, $265,882. Upon boilers and parts of engines they were: For December, 1897, $72,770; December, 1896, $34,044; November, 1897, $94,581; year 1897, $695,267; year 1896, $614,788. Upon printing presses and parts thereof they were: For December, 1897, $128,129; December, 1896, $97,678; November, 1897, $39,218; year 1897, $743,221; year 1896, $530,658.

MISCELLANEOUS.

The engines for the Metropolitan Street Railway plant, in this city, have been decided upon, and the E. P. Allis Company, of Milwaukee, is the fortunate receiver of the contract, which amounts to $500,000, and is one of the largest or-

Continued on page 37.

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Business Specials.

Gear wheels, gear cutting. Grant; see page 16.

Power hammers, Jenkins & Lingle, Bellefonte, Pa.

Forming Lathes. Mer. Mach. Tool Co., Meriden, Conn.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N. Y.

Wants.

Situations and Help Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Situations Wanted.

Mechanical draftsman, 7 yrs. exp. Box 96, Am. Mach.

Mach., eng., dsgnr., d'ftsm'n; pumping mach., engs., etc., open for engagement. Box 78, Am. Machinist.

Wanted—Situation as foreman patternmaker; 20 yrs. exp., 5 yrs. foreman; best of refs. Box 83, Am. Mach.

A young man wishing advancement would like a sit. as foundry foreman; ref. furnished. Box 95, Am. Mach.

Draftsman and machinist, exp. in general machine works, wants situation. Box 88, American Machinist.

Situation by mech. detail draftsman, with prac. shop exp.; industrious, honest, reliable. Box 71, Am. Mach.

Brass foundry foreman wants situation; understands all details in running shop, mixing metals from old and new stock, and a good manager of help; first-class references. Box 92, American Machinist.

Dftsmn., American, of 9 rs'. exp. in various shops and 3 yrs. as dftsmn.; prefers auto. mach. or d'v'l'ping invent.; good ref. from last emp. Box 74, Am. Mach.

Wanted a position by a practical mechanic and designer, experienced in designing and building automatic machinery and interchangeable tools; wire and sheet metal a specialty; would take position as supt. or designer. P. O. Box 498, Bridgeport, Conn.

Mechanical engineer, tech. grad., with seven years' experience in shop, and in charge of design and erection of engines, boilers and power appliances, one year in charge of large Electric R. R. plant, desires position; references. Address Eng., L. Box 91, Hartford Conn

A mechanical engineer, of large experience in the design and manufacture of pumping engines, steam pumps and hydr. machinery, is open for engagement as eng. and supt. of works, or take agency; expert mechanic, designer, manager of works and men; lowest cost of production guaranteed. Box 89, Am. Mach.

Engineer, 32, thorough technical education; member A. S. M. E.; experience as constructing eng. and manager, desires change, knows modern methods of mach. designing and shop practice; exp. on construction Corliss and other engs., air compressors, ice mach. and the most improved gas eng. practice; competent to assume charge of works of any magnitude; pos. as gen. supt. or chief eng. wanted; highest testimonials from all past employers. Box 68, American Machinist.

Help Wanted.

Wanted Draftsman to make detail drawings. Box 93, American Machinist.

Wanted an instructor in pattern making and foundry work. Address, stating experience, age, salary, etc., Box 94, care of American Machinist.

Wanted—Competent, technically educated mechanical draftsman; exp. in hydraulic and power presses and dies for sheet metal required. Box 72, Am. Mach.

Wanted—Capable and energetic foundry foreman for Eastern Canada; shop running heavy work; about twenty men; slide valve and Corliss engine work. Address Box 73, American Machinist.

Wanted—A salesman for special line of machine tools; must be a good mechanic, having experience in the use of turret lathes, automatic screw machines, milling machines, and in designing and making tools. Box 77, American Machinist.

Wanted—Competent young man to take charge of a department employing forty to fifty men making dies for light metallic goods of great variety in steel, zinc, brass, copper, aluminum, &c., by one of the largest concerns in this line. Address Box 75, Am. Machinist.

Foreman in a rifle factory; must be practical mach. and tool maker, and competent to design and make jigs; sober, industrious and have family; not a crank; able to handle men and turn out completed work; also men accustomed to rifle work. Blake Rifle Works, Batavia, N. Y.

Young man, willing to work, seeking an opportunity for future and permanent advancement, having some exp. in machinery, iron and steel or kindred lines, to assist in office and as local salesman; one having some knowledge of stenography preferred. Address, stating exp., reference and salary expected, Steel, Am. Mach.

A superintendent of engine works on permanent night shift; applicant must have had experience in producing good work cheaply; tools are fully up to date; vicinity New York; applicant must state salary expected, and, if possible, relative cost of day and night work under his previous superintendence. Address Box 90, American Machinist.

Miscellaneous Wants.

Advertisements will be inserted under this head at 30 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Job lot radiators, 12 1-2c. ft., S. M. York, Cleveland, O.

Book, Dies & Die Making, $1. J. L. Lucas, Prov. R. I.

The Dutton Wet Twist Drill-Grinder is sold by the Garvin Machine Co., New York City.

Wanted—The latest improvement in gas and gasolene engines. Address F. C. Austin Mfg. Co., Chicago, Ill.

For Sale—Second-hand drill presses, engine lathes and planers. Dietz, Schumacher & Boye, Cincinnati, O.

Best and cheapest Bolt Header, made by Baush & Harris Machine Tool Co., Springfield, Mass.

Light and fine mach'y to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Lathes, planers, drills, milling machines, vises, also brass working machinery second-hand; must be modern and in first-class condition. C. C. Wormer Machinery Co., Detroit, Mich.

Wanted—To correspond with parties having some specialty in the line of machinery to build, by one of the best equipped foundry and machine concerns in the Middle States. Address Box 80, Am. Machinist.

Manufacturer desiring a specialty should investigate small auto. refrigerator machine using no ammonia; four patents pending; no experimental work required; best reference. Refrigerator, Am. Mach.

An American, residing in England, already calling upon users of all kinds of machinery, would like to correspond with manufacturers or patentees, with the view of representing them in England or on the Continent. Address A. E. L., 135 Balfour st., Hull, Eng.

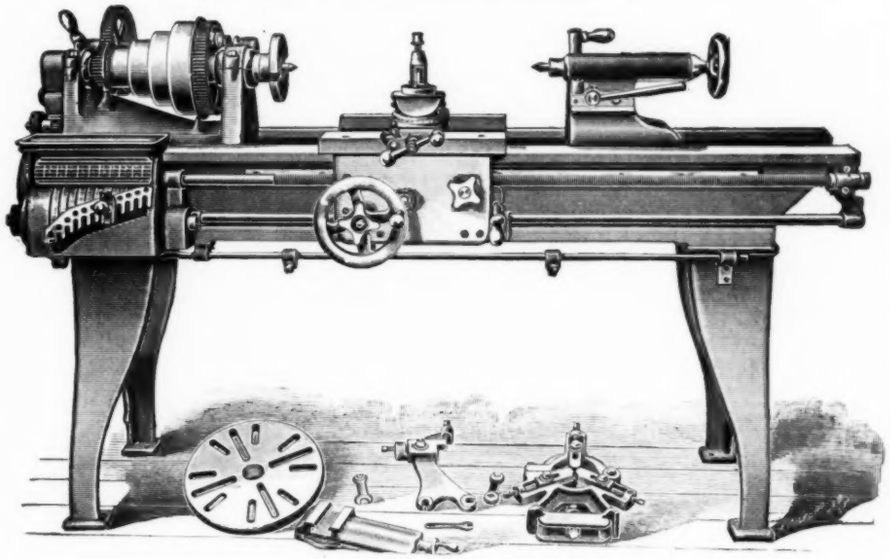
Brains and hands do their best work in the field of their experience. The Century Machine Co., 576 West Broadway, New York, employs trained brains and trained hands in the persons of mechanical experts who are competent to solve intricate mechanical problems and make operative models. The designing of automatic and labor saving machinery is in charge of Mr. Oluf Tyberg and assistants. The Century Machine Co. is equipped with most modern tools as well as men. Light machine work, experimental work, model making and manufacturing solicited.

WANTED.

To manufacture light machinery on royalty or with privilege to buy; inventions developed confidentially. Address

SUCCESS, American Machinist.

THIS LATHE COMBINES THE LATEST AND BEST IMPROVEMENTS.



14 in. x 6 ft. Hendey-Norton Lathe

With Improved Automatic Stop.

• • •

AUTOMATIC STOP.

It is durable, simple, indispensable. It will automatically stop the carriage in either direction. It is equally efficient whether feeding or thread-cutting, running up to a shoulder, boring to bottom of holes, or internal thread-cutting. No danger of spoiling either tool or work. It is a safeguard against accidents in either direction.

CARRIAGE.

The carriage reverses in apron; no slamming of countershaft. There is no comparison between this lathe and the old style or common lathe.

THREADS.

It has all threads in daily use with simple movement of lever.

FEEDS.

Has all feeds in daily use with simple movement of lever. Send for Circular.

• • •

THE HENDEY MACHINE COMPANY,

Torrington, Conn.

Agents for the Pacific Coast, PACIFIC TOOL AND SUPPLY CO., San Francisco, Cal.

J. W. CREGAR, Philadelphia Bourse Exhibition.

European Agents, { SCHUCHARDT & SCHUTTE, Berlin, Vienna, Brussels, Stockholm.
CHAS. CHURCHILL & CO., Ltd., London and Birmingham, Eng.
ADPHE. JANSSENS, Paris, France.

ders it has ever taken. The capacity of the plant is to be 70,000 horse-power.

From a circular letter sent us by the Warren Webster Company, Camden, N. J., giving a list of some two dozen contracts for installation of their system of steam heating from December to date, we notice that in the machinery line some Pennsylvania Railroad shops, the plant of the Norton Emery Wheel Company and the Singer Manufacturing Company's "New Foundry" are thus being improved.

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Quotations.

NEW YORK, Monday, February 21.

Iron—American pig, tidewater delivery:

No. 1 foundry, Northern	$11 75 @ $12 25
No. 2 foundry, Northern	11 00 @ 11 50
No. 2 plain, Northern	10 75 @ 11 25
Gray forge, Northern	10 25 @ 10 50
No. 1 foundry, Southern	10 75 @ 11 00
No. 2 foundry, Southern	10 25 @ 10 50
No. 3 foundry, Southern	10 00 @ 10 25
No. 1 soft, Southern	10 75 @ 11 00
No. 2 soft, Southern	10 25 @ 10 50
Foundry forge, Southern	9 75 @ 10 00

Bar Iron—Base—Mill price, in carloads, on dock: Common, 1.07½ @ 1.10c.; refined, 1.15 @ 1.20c. Store prices: Common, 1.25 @ 1.35c.; refined, 1.30 @ 1.50c.

Tool Steel—Ordinary sizes, standard quality, 6 @ 7c., with some grades perhaps a little less; extra grades, 11 @ 12c.; special grades, 16c. and upward.

Machinery Steel—Ordinary brands, from store, in small lots, 1.45 @ 1.60c.

Cold Rolled Steel Shafting—Base sizes, from store, in retail lots, about 2.20c.

Copper—Carload lots, Lake Superior ingot, 11⅜ @ 11½c.; electrolytic, 11⅜ @ 11¼c.; casting copper, 11 @ 11⅛c.

Pig Lead—Carload lots, 3.80 @ 3.85c., f. o. b. New York.

Pig Tin—For 5 and 10 ton lots, 14 @ 15c., f. o. b.

Spelter—Carload lots, 4.10 @ 4.15c., New York delivery.

Antimony—Fair wholesale prices on the various brands, 7.60 @ 8.25c.

Lard Oil—Prime city, present make, 45 @ 46c. quoted for a good commercial brand.

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Manufacturers.

At Port Jervis, N. Y., Duffy Brothers are erecting a new mill.

The Monroe Road Machine Company is to ocate a new plant at Anderson, Ind.

At Concord, N. C., the Coleman Manufacturing Company is erecting a cotton mill.

The St. Cloud Iron Works, of St. Cloud, Minn., is to make additions to its plant.

The St. Louis Car Company has commenced the erection of a new plant at Baden, Mo.

At Walker, Minn., T. B. Walker and H. C. Akeley, of Minneapolis are to erect a saw mill.

The Oliver & Snyder Steel Company, of Manchester, Pa., is about to erect additions to its plant.

The Dubois, Pa., Electric Light Company has let contracts for the erection of a new power house.

The Hawley Down Draft Manufacturing Company contemplates the erection of a new plant at Atlanta, Ga.

It is reported that Coffin, Francis & Perceval are interested in the erection of a factory at Brightwood, Ind.

T. J. Hern, of New Albany, Ind., expects to establish a factory for the manufacture of mineral wool at Alexandria, Ind.

The Symonds & Poor Carbonator Company, of New York city, has been incorporated to manufacture carbonators, by Nathan Meyer, 250 West

Ninety-ninth street, F. B. McDonald and Frederick Eder, of New York city.

The Baldwin Locomotive Works have recently reveived an additional order for fourteen locomotives to go to Russia.

The Buffalo, N. Y., Iron Works is to enlarge its plant at an early date. A new building, 80x120 feet is to be erected.

The Pennsylvania Car Wheel Company, Allegheny, Pa., is to erect a new iron plant, 70x266 feet, on Preble avenue, to cost $14,500.

The contract for a new brick power house, 40x80 feet, has been let by the American Steel Casting Company, Sharon, Pa., for $4,000.

At Spartanburg, S. C., T. F. Hunt, W. A. Adams and D. W. Ebaugh, of Greenville, contemplate the erection of a roller mill.

The Washburn Coupler Company, of Minneapolis, Minn., has been incorporated by W. D. Washburn, E. C. Washburn and Caleb C. Crane.

At a recent meeing of the stockholders of the Tampa, Fla., Waterworks Company it was decided to make some improvements to the property.

It is expected that the Bettendorf Metal Wheel Company, of Lagonda, Ohio, will make additions to its plant. One of the buildings will be 175x80 feet in area.

At Pittsburg, Pa., the Robinson-Rea Manufacturing Company contemplates the erection of a machine shop. The building will cover an area of 90x180 feet.

At Chicago, Ill., the Bothner-Schrader Company has been incorporated to manufacture machinery. Incorporators, Wm. Bothner, Maurice P. Schrader and Joseph H. Mulke.

The Rice & Sargent Engine Company, the Providence Steam Engine Company and the Builders' Iron Foundry, all of Providence, R. I., have entered into a combination.

The United States Radiator Company, of West Newton, Pa., will make extensive additions to its plant. It is expected the additions will enable the company to double its output.

Application has been made by the Minneapolis, Minn., Iron Company for a permit to erect a factory on Bradford street, St. Anthony Park, that city. The structure will be 62x72 feet.

The Phoenix Sash & Door Company's building on Franklin avenue, Minneapolis, Minn., has been leased to the Honstain-Rocheholt Manufacturing Company, manufacturer of rice and coffee fanning mills.

Mr. Edward B. Hawkes, of Athol, Mass., has purchased the machinery and tools in the machine shop of W. H. Sleeper. He will refit the shop and probably install more machinery.

The big cold storage warehouse at Delaware avenue and Noble street, Philadelphia, is to be enlarged to about double its present size. Plans have been drawn providing for an addition to the building, which will measure 62x150 feet and be eight stories. The cost will be about $100,000.

The Bruce Generator Company, of St. Paul, Minn., has been incorporated with a capital stock of $50,000 for the purpose of manufacturing gas generators and fixtures. The incorporators are V. P. Roberts, of Minneapolis; H. B. Cram, St. Paul Park; L. S. Breher and Charles Karst, St. Paul.

The Marinette, Wis., and Menominee Paper Company, at a meeting recently, decided to rebuild the sulphite plant destroyed by the explosion on a larger scale than before. A mill to cost over $50,000 will be put up. It will be a brick building with modern machinery and all the latest appliances.

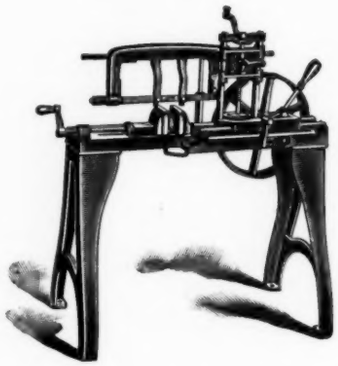
An agreement has been reached between the Toronto, Ont., Rubber Company and the Hull City Council in regard to the company removing their factory to Hull. In return for a bonus of $30,000 and fifteen years' exemption from municipal taxation on their improvements, the company agrees to establish a factory within the limits of the city and expend on the building

The

Q & C

Automatic

Shop Saw.



Special Machinery

For Cutting All Kinds of Iron and Steel Cold. . . . . .

The Q & C Co.,

700-709 Western Union Bldg., CHICAGO, ILL.

100 Broadway, NEW YORK, N. Y.

537 Mission Street, SAN FRANCISCO, CAL.

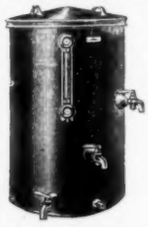
EXPORT TRADE.

English engineer wishes to represent American firm in Europe; fluent German; some French; has had experience in English trade. Box 91, AMERICAN MACHINIST.

FOR SALE.

One-half interest in United States patent No. 580,027, Wiltse's improved wrench; a complete invention; simple, practical, efficient; this improvement is designed for very quick and convenient adjustment and is very substantial in its construction, while but little cost is involved in its manufacture; the implement is compact, strong and has no harsh, massive projections; indorsed by gas and steam fitters, plumbers, master mechanics of leading railroads, &c.; sells on sight; large profits; $1,000 required. Address OWNER, P. O. Box 850, Denver, Col.

THE CROSS OIL FILTER



actually reduces oil bills 50% or more. Sent on approval. Used in 17 countries. Testimonials from leading firms in every field of industry.

Business established eight years.

THE BURT MFG. CO.
AKRON, O., U. S. A.

Largest Manufacturers of Oil Filters in the World.

CENTURY MACHINE CO., Machinists, Manufacturers, Model Makers and Contractors.

OLUF TYBERG, Mechanical and Consulting Engineer.

Both at 576 West Broadway, New York.

THEY WORK TOGETHER OR INDEPENDENTLY.

Index Milling Attachment.

A cheap and useful attachment for engine or other lathes, that enables a tool-maker to flute taps, reamers, counterbores etc., and do light milling required in tool-rooms or small shops.

ERNEST F. ROBBINS, Burrville, Conn.

DO MACHINE SHOPS give the same attention to their MOTIVE department as other plants? We think not.

The IMPROVED ROBERTSON --- INDICATOR ---

settles beyond a doubt whether your ENGINE is developing full power for fuel consumed and enables you to determine the horse-power of leased power.

WE MAKE OTHER GOODS

SUCH AS

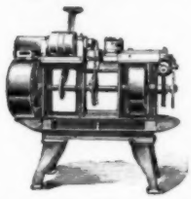
EXHAUST HEADS—PLANIMETERS—STEAM SEPARATORS—OIL FILTERS—HEATERS—OIL EXTRACTORS—SHAKING GRATES—3-WAY VALVES—ELBOW COCKS—EUREKA PACKING.

Our Catalogue describes all of these. Don't YOU want one?

JAS. L. ROBERTSON & SONS,

209 Fulton St., New York. 12 Pearl St., Boston.

Spencer Automatic Screw Machines



in eleven sizes, for Making Screws, Studs, Bicycle Hubs and other pieces of circular cross-section and various outlines from bars of round, square, or hexagon metal, in diameter 1/16 to 3 1/16 inches.

All needed adjustments are provided for. One boy may attend a half dozen machines.

Tools made to order. Nut Tapping, Screw Head Shaving and Slotting Machines.

Ask for the Machinist's Catalogue.

The Pratt & Whitney Co., Hartford, Conn., U.S.A.

NEW YORK: 123 Liberty St. BOSTON: 144 Pearl St. CHICAGO: 42 S. Clinton St. LONDON, ENG.: Buck & Hickman, 280 Whitechapel Rd. PARIS, FRANCE: Fenwick Freres & Co., 21 Rue Martel.

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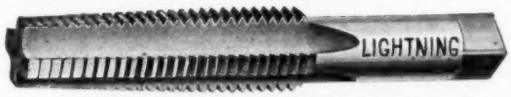

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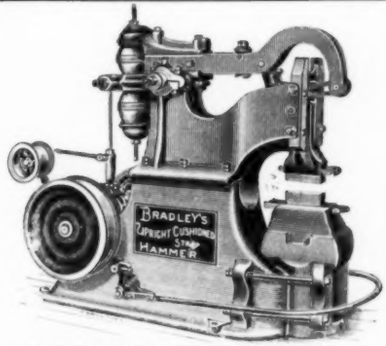

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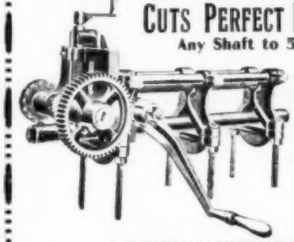

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The certificate of incorporation of the George D. Pohl Manufacturing Company, Utica, N. Y., to conduct a general manufacturing business, and particularly the manufacturing of gas and gasolene engines and steam engines and general foundry work, in Vernon, has been filed with the County Clerk.

George C Nimmons has finished preliminary drawings for the printing plant which the W. B. Conkey Company contemplates erecting at Hammond, Ind., as soon as the now pending real estate negotiations are completed, of which there is every prospect. This work will involve an expenditure of $150,000.

M. C. Henry & Co., of New York city, are enlarging their plant and making improvements. Their new steel stone shed, which is about 50 feet wide, is to be extended about 70 feet in length. The metal work, which consists of the steel framework of the building, the covering upon the roof and sides, and the metal runway for traveling crane, is being furnished and erected by the Berlin Iron Bridge Company, of East Berlin, Conn.

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The General Electric Company has issued a publication entitled "Operation of Electric Mining Plants." It contains engravings of various styles of electric locomotives for use in coal mines, also electric pumping machinery.

The Mergenthaler Linotype Company, of New York, has sent us three catalogs descriptive of the Linotype, with especial reference to the use of the machine in book offices. The different parts of the Linotype are minutely described.

We are in receipt, from W. S. Rockwell & Co., New York, of a catalog of the Rockwell fuel oil burner, together with other appliances pertinent to the use of oil for the purpose of generating heat. The catalog is 7½ x 10 inches.

We have received the Cornell University Register for 1897-1898. Detailed accounts of the various accounts are given, and we note that the department of mechanical engineering has on its rolls this year 463 students. The register contains 334 pages.

The Detrick & Harvey Machine Company, Baltimore, Md., has sent us catalog containing illustrations and descriptions of bolt threading and nut tapping machinery. Line engravings of the dies and head are included. The catalog is 6x9¼.

The Waterbury Farrel Foundry and Machine Company, Waterbury, Conn., sends us a number of circulars describing and illustrating various kinds of machinery used in the manufacture of bicycles, hardware, tubes, silverware, &c. They are 5¼x7 inches.

We have received from the Wolverine Motor Works, Grand Rapids, Mich., copy of their 1898 catalog devoted to the illustration and description of marine and stationary gas and gasolene engines and launches. These motors are made with one, two and three cylinders. The catalog is standard size, 6x9 inches.

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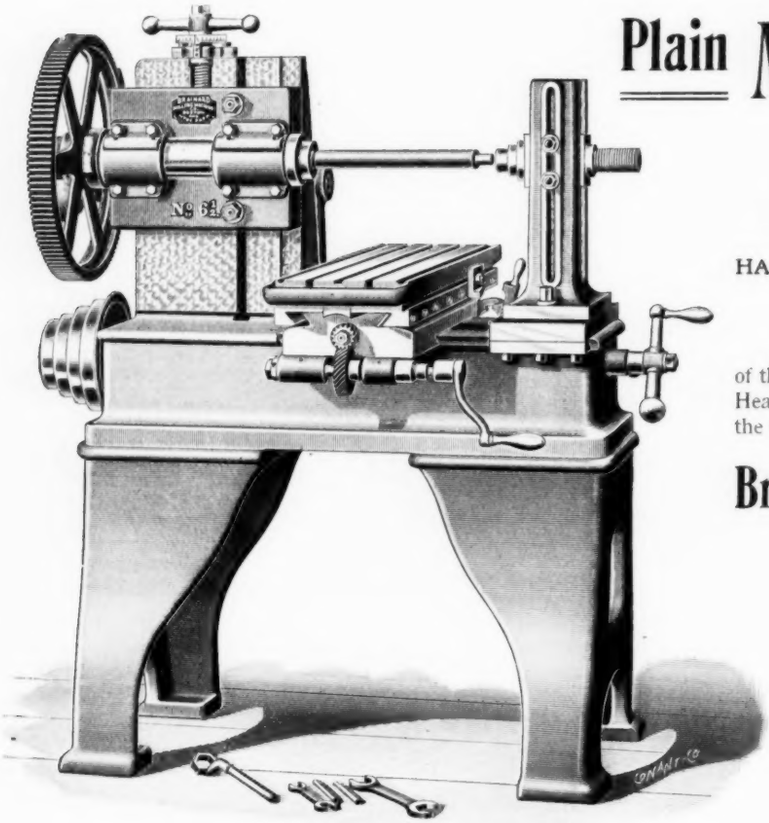

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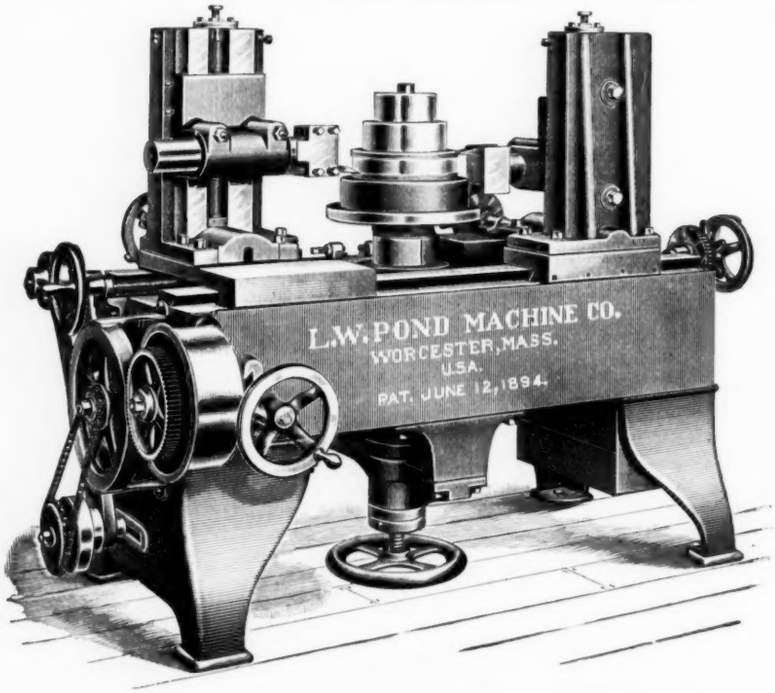

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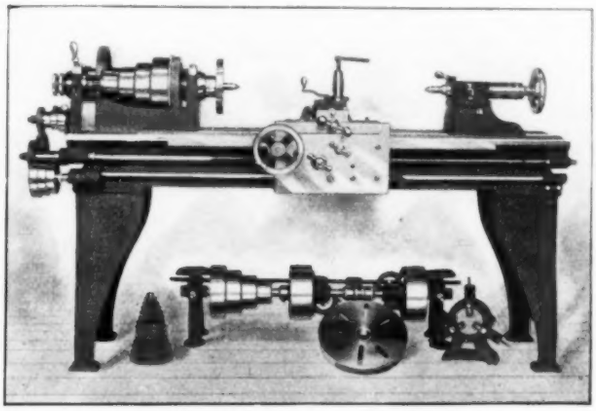

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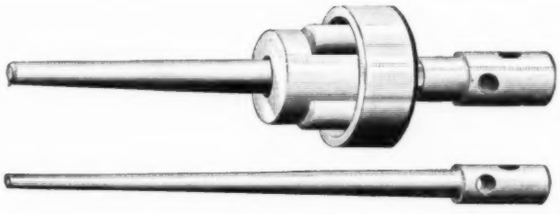

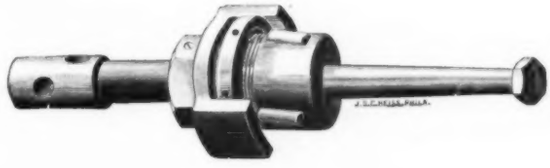

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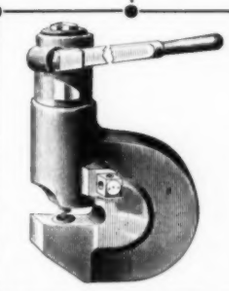

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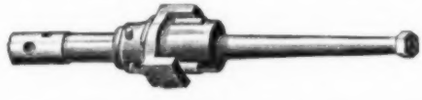

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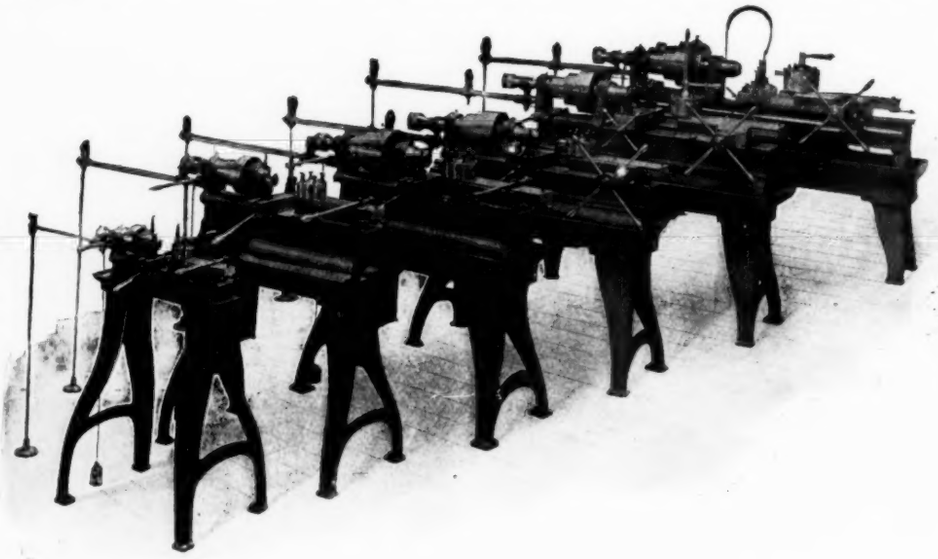
No. 00,	9-16 in.
No. 1,	13-16 "
No. 2,	1¼ "
No. 2½,	1 9-16 "
No. 3,	2 5-16 "
No. 11,	1¼ "
No. 12,	1 9-16 "
No. 12½,	2 5-16 "
No. 13,	3⅛ "



WIRE FEED CAPACITY:

No. 00,	¼ in.
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No. 2,	⅞ "
No. 2½,	1¼ "
No. 3,	1 15-16 "
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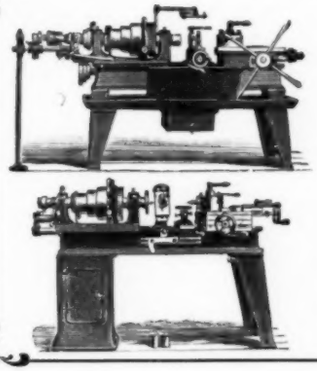

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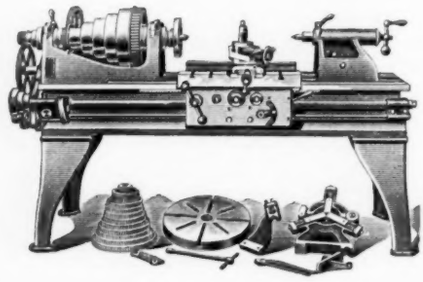

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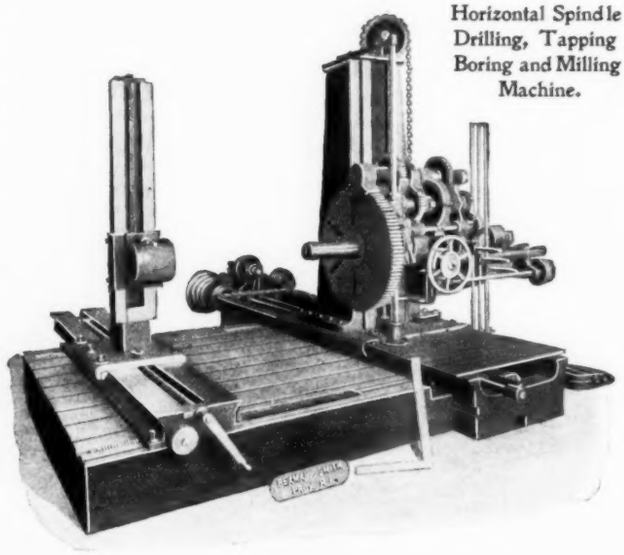

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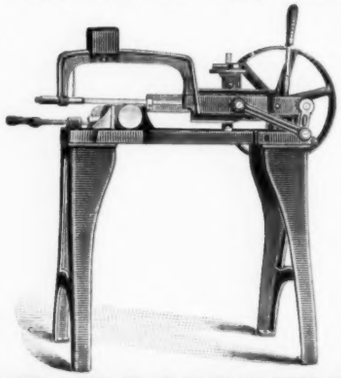

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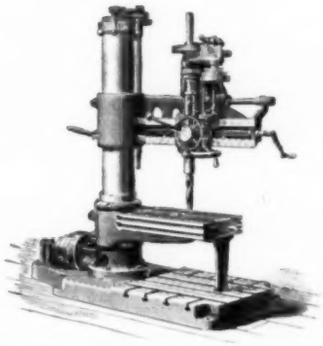

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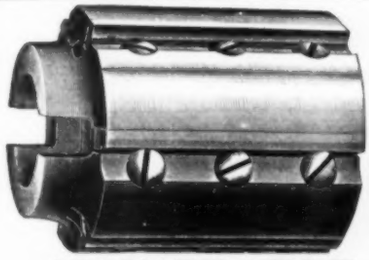

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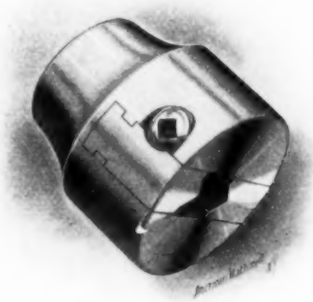

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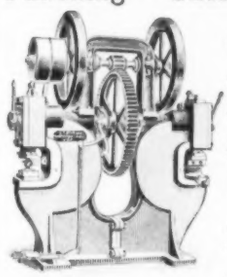

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To Punch a ¾" hole through ⅝" stock, up to a 1" hole through 1" stock.
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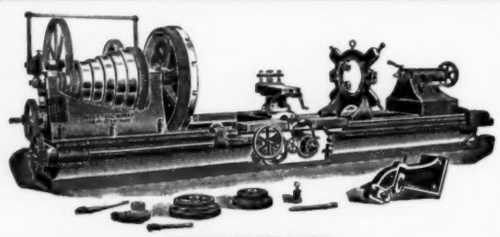

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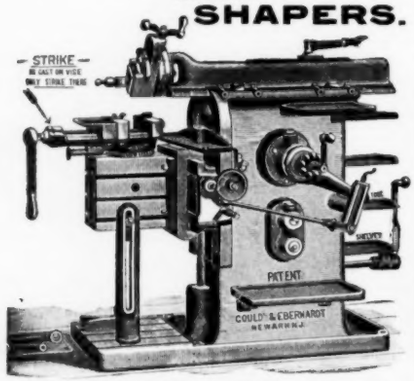

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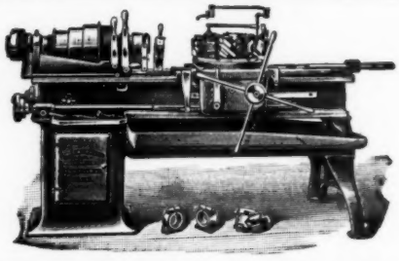

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